On the Symbiosis of People and Building
The Perfect Slum

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DOCTORAL THESIS

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Résumé

Des controverses continuent d'exister entre les architectes et le grand public à propos de ce qu'est-ce un « bon » bâtiment. L'architecture moderne est souvent dépréciée par le grand public et, dans la vie quotidienne, les gens blâment l'architecte pour tout ce qu'ils trouvent peu pratique dans un bâtiment. La fenêtre qui ne s'ouvre pas est emblématique de cette controverse. Le nœud du problème réside dans le manque de connaissances sur la façon dont les gens entrent en relation avec leurs bâtiments.

Cette thèse étudie la relation entre les gens et leurs bâtiments, un sujet qui se trouve à l'interface de l'architecture, de la psychologie et de l'anthropologie. Cette thèse vise à construire une théorie qui soit à même de relier les idées propres à ces disciplines.

L'importance de ce sujet réside dans l'aliénation croissante des personnes par rapport à leurs bâtiments. Bien que beaucoup d'architectes travaillent sur des bâtiments avec lesquels on puisse établir une relation de meilleure qualité, l'aliénation continue d'exister, notamment en raison du fait que l'environnement bâti n'est pas uniquement le produit des architectes. Dans le monde multidisciplinaire, l'amélioration de la relation de l'homme à l'édifice pourrait tirer profit de la définition d'un axe de réflexion et un cadre conceptuel approprié.

De la littérature, on a recueilli des idées qui expliquent la relation de l'homme à l'édifice selon quatre perspectives: les aspects humains, les propriétés des bâtiments, leur rapport à la société, et les systèmes abstraits. Ensemble, ils forment un modèle qui peut servir d'axe de réflexion. Ensuite, afin d'identifier ce qui est en train de changer dans la relation de l'homme à l'édifice, ce modèle a été utilisé comme outil de recherche dans différents contextes: des habitats traditionnels, des bâtiments modernes et des situations intermédiaires: le logement primitif dans l'habitat informel ou le bidonville.

De nouvelles méthodes de recherche détaillées portant sur l'observation et le relevé de l'interaction des individus avec les bâtiments ont été développées et combinées avec les techniques d'échantillonnage et de codage existantes. Les outils de l'architecte, tels que le croquis, la maquette et la photographie ont été utilisés, parallèlement au recours à l'interview et à l'observation participative.

Les résultats sont présentés dans plusieurs rapports allant de taudis à haut-technologie. Outre l'architecture, ils décrivent les pratiques quotidiennes, les logiques et les incohérences des méthodes de construction, et les effets sur la relation personnes-bâtiment.

D'après les résultats obtenus, nous concluons que ce qui est advenu de cette relation dans la transition du vernaculaire au moderne peut être décrit en cinq tendances. Ces tendances expliquent la déconnexion actuelle entre l'usager et l'édifice, ainsi que les difficultés que nous rencontrons à créer des bâtiments qui soient vivants. En

combinaison avec l'axe de réflexion, cela définit alors un cadre conceptuel contenant les motifs typiques de la relation personnes-bâtiment.

La recherche suggère que, dans le but de créer une relation forte entre les personnes et les bâtiments, l'ensemble du processus de construction, d'habitation, et d'exploitation quotidienne doit être axée sur l'inclusion de l'utilisateur final. La réglementation et la technologie actuelle favorisent l'exclusion et contribuent donc au développement d'un environnement bâti qui n'est pas humainement durable.

Mots clés
Architecture vernaculaire, Anthropologie de l'habitat, Habitat informel, Amélioration de bidonvilles, Participation des usagers, Construction durable, Automatisation du bâtiment.

Abstract

Controversies continue to exist between architects and the public about what is a good building. High-style modern architecture is often disliked by the public. Moreover, in everyday life people blame the architect for everything they find impractical in a building. The non-operable window is emblematic of this controversy. The kernel of the problem lies in the lack of knowledge about how people relate to their buildings.

This thesis investigates the relationship between people and their buildings, a topic that lies on the interface of architecture, psychology, and anthropology. In architecture, many have attempted to create buildings that feel alive, although much of what is built today feels alien to those who inhabit it. Environmental psychology has its focus on perception and meaning, whereas in anthropology, the habitat is often observed in a cultural perspective. This thesis aims at building theory that connects the insights of these disciplines.

The importance of the topic lies in the increasing alienation of people from their buildings. Although many architects work on buildings that we can better relate to, alienation and disconnection continue to exist because, to mention one aspect, the built environment is made by more people than only architects. In the multidisciplinary world, improvement of the relationship of people and building would surely benefit from the introduction of a clear focal point and an adequate conceptual framework.

From literature, insights were collected that explain the relationship in four perspectives: human aspects, properties of buildings, its relation to society, and abstract systems. Together they form a model that can serve as the focal point. Next, in order to identify what is changing in the relationship, the model was used as research tool in different contexts, ranging from vernacular to modern. Fieldwork research was conducted in traditional habitats, state-of-the-art high-tech buildings, and settings in between: primitive housing in urban slum or informal settlement.

Detailed research methods for the survey of people's interaction with buildings were originally developed during fieldwork and combined with existing sampling and coding techniques. Architect's tools like sketches, scale models, and photography were used along with interviews and participatory observation.

Results are presented as studies on symbiosis in vernacular architecture, slum dwellings, and hi-tech buildings. Besides architecture, they describe the practice of everyday life, logic and inconsistencies in building methods, and effects on the people-building relationship.

The findings showed that what happened to the people-building relationship in the transition from vernacular to high-tech, could be described in five trends. These trends explain the current disconnection as well as the difficulties we face in creating live

buildings. Thus, together with the focal point, a conceptual framework for the people-building relationship is created. The profession can use this knowledge as both tool and theory.

The research suggests that in order to create a strong people-building relationship, the whole process of building, dwelling, and daily operation must be focused on inclusion of the end-user. Today's technology and regulations favor exclusion and therefore contribute to a built environment that is not sustainable for humans.

Key Words
Vernacular architecture, anthropology of the habitat, informal settlement, slum improvement, user participation, sustainable building, building automation.

Introduction

Besides the people around us, buildings are the most present partners in our life. Much of daily life takes place in a variety of buildings, of which the home is the one we are closest to. Our relationship with buildings goes beyond the practical and the physical; it includes psychological and social aspects too. Authors like Christopher Alexander, Jane Jacobs, and John Habraken, have pointed out that in the flow of modernity; our relationship with buildings is changing. They identified a trend of disconnection, caused by our built environment becoming less alive. Numerous professionals have worked on bringing back life in and between buildings. Too often though, intentions and results go different directions.

Migration to cities through industrialization often has the formation of slums as a side effect. Despite the aversion that many have to slums, it is the most primary architecture produced by people creating a home in a swelling city. Given its magnitude, the phenomenon of slum must hold clues to how dwelling relates to life.

In sustainable building, much attention is paid to ecological aspects like energy efficiency and waste reduction. Governance and technology are dominant in the debate. Consequently, solutions are mainly of a regulatory and technical nature. Problematic however, is the ongoing disconnection in the form of increasing exclusion of the end-user. The biggest risk hiding in hi-tech solutions for making buildings ecologically sustainable is that they are not humanly sustainable.

It is therefore essential to appreciate the people-building relationship. This thesis takes the 'life' factor in that relationship as the focal point of the investigation. The aim is to create a model of the relationship and to provide a conceptual framework by which changes and challenges in that relationship can be described. The application of the resulting theory lies in both design and policymaking.

The structure of this thesis follows the typical pattern of problem statement – literature review – methods – results – discussion - conclusions. It investigates the relationship between people and building in several settings, ranging from vernacular to high-tech. Although all elements are part of the overall argument, one section of the results can also be read separately: the results of the case study on 'vernacular and transitional' are an architectural account of informal settlement.

This thesis is written in order to obtain a doctoral degree. It is the author's firm belief that the profession of architecture is in need of more knowledge about the human factor. This thesis is an initiative to build the necessary theory.

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Lausanne, summer 2015

Sytse de Maat

Credits

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The Problem

"The designer's chances of success are small because the number of factors which must fall simultaneously into place is so enormous" (Alexander, 1964).

Rationale for the Study

All buildings, from primitive dwelling to high-tech tower, have in common that they accommodate human activity. They do so by providing support for living and shelter from natural conditions. Consequently, people cannot do without buildings, and being made by man, buildings cannot exist without people. This may sound like a simple interdependence, but since man has lived in buildings for generations, the relationship between man and building is more profound than practicality. Like clothing is often considered the second skin, building is the third, and thus becomes part of the body. Since we spend most of our time inside buildings or in their vicinity, they are our physical connection to the rest of the world. In addition to the physical and instrumental aspects, the connection is of existential importance: buildings are our connection with the universe, with God. "Thus it was that the house, like the temple and the city, became a symbol of the universe with man, like God, at its center and in charge of its creation" (Cooper, 1974).

In analogy with biology, the relationship of people and building can be described as a symbiosis, in which building is considered a life form in symbiosis with people. In this thesis, symbiosis is about how people and building get along, how they accommodate each other, how they live together, and thus together are a life form. Dwelling is an example of symbiosis. Both the noun and the verb mean the specific combination of people and building. With the introduction of all kinds of new technical and formal processes, the symbiosis is rapidly changing. The way we dwell today is very different from centuries ago.

Various authors, among whom Christopher Alexander (1979), Irena Bauman (2008), John Habraken (1961), and Edgar Morin (1993), have signaled trends of disconnection of people from building. Although this disconnection seems widely felt, little is clear about its causes and its relation with other trends in the symbiosis. A complicating factor is the multidisciplinary character of this topic. Characteristics of buildings are researched and taught in architecture schools often part of institutes of technology, whereas studies on human behavior have their home in universities. In addition to this already deep divide, disciplines like architecture, psychology, anthropology, sociology, and economics each have their specific research traditions and philosophies.

The urge to find solutions to problems is in the nature of creative people and engineers. Much of their research is action research, i.e. on how to put their solution into realization. However, this focus probably hinders them in identifying causes. Many design strategies works on managing symptoms, less on curing the disease. By mapping the connection of people and building, this thesis aims at providing a conceptual framework by which the causes of disconnection can be identified and assessed, and through which remedies may be found. The key concept used in this thesis is symbiosis, e.g. this disconnection is considered a disruption of the symbiosis.

One of the causes of the gap between architecture and social sciences is explained in *Psychology for Architects* (Canter, 1974) "One reason why so little study has been made of the relationships which people take up *vis-à-vis* their *physical* surroundings is the observation that much of human spatial behavior is more readily explained in respect to other *people*." Canter reaches out with a call for research: "much of academic psychology has developed if not in ignorance of the physical environment then at least without paying much attention to it. Thus there is a tremendous amount of work to be done both in the development of psychological concepts and in carrying out the necessary research before a discipline will emerge which will be seen to contribute directly to the processes of design" (Canter, 1974). In a review of the social and cultural processes involved in the development of self-identity, Proshansky, Fabian, and Kaminoff (1983) observed an almost complete neglect of the role of places and spaces in this aspect of human psychological development. Consequently the authors made the assumption that "the development of self-identity is not restricted to making distinctions between oneself and significant others, but extends with no less importance to objects and things, and the very spaces and places in which they are found."

The neglect of the role of place and space is visible in dictionary entries on psychology:

> "Scientific discipline that studies mental processes and behaviour in humans and other animals. Literally meaning "the study of the mind," psychology focuses on both individual and group behaviour." (Merriam-Webster Online Dictionary and Thesaurus, n.d.)

> "The scientific study of the way the human mind works and how it influences behaviour, or the influence of a particular person's character on their behaviour" (Cambridge English Dictionary & Thesaurus, n.d.)

Even if human behavior is studied in a certain built environment, as in ecological psychology for example, it often involves studying behavior in a setting of others' behavior rather than in a building (Barker, 1968; Proshansky et al., 1983). The physical environment is used as a delimitation tool for groups of subjects (people). Still, behavior is then studied as among people, not in interaction with built form.

Another factor is that the relationship of people with their buildings is inevitably subject to the mechanization of the worldview, which easily boils it down to a 'user – tool' equation. Jonathan Hill for example, considers the hybrid of people and building either a building with the characteristics of a physical body or building with intelligence (Hill, 2003). Using building as a utensil, or operating it, handling it, is not recognized as such.

The lack of interdisciplinary crossover becomes visible in cases where people are displaced, and especially in crises. Relocation authorities, who assume that people just need new housing, are not aware of the considerable disruption of place attachment that residents undergo in addition to the loss of social, cultural, and physical grounding (Brown & Perkins, 1992; Grisel, 2010; Porteous & Smith, 2001).

Theoretical Framework

The idea for the topic of this thesis is based on the work of Christopher Alexander. In *The Timeless Way of Building* (1979) Alexander describes his quest for the quality that makes buildings alive. His concern about modern building is that it often lacks this live quality, and his ambition is to build a theory that describes the "quality that has no name". Part of this theory has reached the audience under the title *A Pattern Language* (Alexander, 1977).The existence of buildings that are alive as compared to other buildings that are dead can readily be understood. The work of Alexander will be discussed further in the literature review on page 36+.

The idea of live buildings gave rise to the idea that, since people are alive too, the relationship between people and their buildings is a symbiosis. In biology, symbiosis is a combination of two life forms that benefit from each other. The combination can even have properties not found in the two life forms of which it is composed. Lichen is a known example. In some lichen, the mutual dependence is so strong the composing organisms cannot survive without the symbiosis.

Symbiosis in the biological sense requires that buildings are organisms, whereas they are inanimate. In this thesis, the use of symbiosis is similar to Sim van der Ryn's use of 'a building is an organism' in his description of ecological architecture.

> Ecological architecture takes nature as the foreground and not as the background, actively works with ecological processes, and uses ecology not only in practical ways but metaphorically, so that organism becomes the metaphor for buildings, not object.

> A building is an organism. Some buildings can actually be considered ecosystems, and buildings are part of larger ecosystems. I think this shift in metaphor implies a whole different design process and a different set of concerns than the traditional ones in architecture (Van der Ryn 1994 cited in (Downton, 2009)).

Where Van der Ryn aims at integrating architecture in ecology i.e. a wider context, symbiosis in this thesis aims at the singularity of the man-building relationship.

Another part of the theoretical framework of this thesis is the dichotomy of vernacular and commodity. As argued in this chapter, vernacular is marked by its link to the personal, physical, and social environment, whereas a commodity is intended for the market and thus made in abstraction from the home environment. Symbiosis is by definition a phenomenon of relationships, and symbiosis as a concept is thus hypothetically of vernacular character. The following review of the definition of vernacular will help sharpen this idea.

Perhaps the first mention of vernacular as a category in architecture is in the preface of a 1964 book by Bernard Rudofsky:

> *Architecture Without Architects* attempts to break down our narrow concepts of the art of building by introducing the unfamiliar world of non-pedigreed architecture. It is so little known that we don't even have a name for it. For want of a generic label, we shall call it vernacular, anonymous, spontaneous, indigenous, rural, as the case may be (Rudofsky, 1964).

Rudofsky describes this vernacular architecture as a "*communal* architecture – architecture produced not by specialists but by the spontaneous and continuing activity of a whole people with a common heritage, acting within a community of experience" (Rudofsky, 1964).

According to Paul Oliver, vernacular architecture is often understood as indigenous, tribal, folk, peasant, and traditional (Oliver, 1997). It is often seen as something of the past and high-style modern architecture is its typical counterpart. Various attempts have been made to come to an adequate definition of vernacular architecture, but given the vastness of the vernacular dwelling stock, 800 million according to Oliver (1997), it was often taken as self-evident.

Amos Rapoport contributed to the definition of vernacular. In *History and Precedent in Environmental Design* (1990b), Rapoport notes that although architects play a role in creating the built environment, the majority of structures are built without their involvement. Rapoport thus relates to Rudofsky's notion of 'architecture without architects.'

The apparent need to label this type of architecture brings to light another debate. Rapoport mentioned "the majority of structures", and Oliver referred to "the vastness of the vernacular dwelling stock" whereas Rudofsky spoke of "the unfamiliar world of non-pedigreed architecture" and "It is so little known..." This suggests that what we call vernacular architecture today was not readily considered architecture in 1964. The search for a definition of vernacular architecture is therefore not only a matter of identification; it is also a call for recognition and inclusion in the domain of architecture.

Amos Rapoport is one of the founders of Environment Behavior Studies and an important part of his work is in the domain of anthropology. In **Vernacular Design as a Model System** (2006), he suggests to take vernacular environments as units of analysis rather than buildings, since Environment Behavior Studies go beyond the realm of design architecture and the setting of behavior consists of more than built structures alone. "It is not sufficient to study just buildings; one needs to study systems of settings within which systems of activities take place. [...] At the most abstract level, vernacular design produces particular types of environments, which can be conceptualized as organizations of space, time, meaning and communication" (Rapoport, 2006). This contextual approach is also visible in **Defining Vernacular Design** (Rapoport, 1990a) where he grouped the attributes of vernacular environments into two categories: *process characteristics* and *product characteristics* (listed in Appendix 2: Characteristics of Vernacular Environments).

Despite their comprehensiveness, Rapoport's two lists are mainly a framework for detailed description rather than a definition of vernacular. In mathematics, they would be a collection of descriptions of pieces of a graph, whereas one single integral formula would be more accurate and probably more efficient.

In the introduction of the *Encyclopedia of Vernacular Architecture of the World*, Paul Oliver similarly faced the abundance of defining attributes, the summary of which he offers as a 'working definition':

> Vernacular architecture comprises the dwellings and all other buildings of the people. Related to their environmental contexts and available resources, they are customarily owner- or community-built, utilizing traditional technologies. All forms of vernacular architecture are built to meet specific needs, accommodating the values, economies, and ways of living of the cultures that produce them (Oliver, 1997).

Still, this is mainly a set of characteristics rather than a delimitation of the category, and not yet a succinct and convincing definition of vernacular architecture. As Rapoport already argued, most definitions so far were *implicit*, whereas an *explicit* definition is essential for the scientific and scholarly debate (Rapoport, 1990a). A more explicit formula was created in *Learning from Vernacular* by Pierre Frey (2010). Frey applies Ivan Illich's definition of vernacular to architecture. Illich put it this way:

> [Vernacular] is a technical term that comes from Roman law. It can be found there from the earliest records, up to the codification by Theodosius. It designates the inverse of a commodity. "*Vernaculum, quidquid domi nascitur, domestici fructus; res quae alicui nata est, et quam non emit*" (Du Cange, 1736). 'Vernacular' means those things that are homemade, home-spun, homegrown, not destined for the market, but that are for home use only (Illich, 1983).

In short: Vernacular designates the inverse of a commodity. The distinction between home and market is contextual, which makes this definition fit with Rapoport's preference for environment over building. For Frey, Illich' notion gave rise to another definition:

> "In the globalized world of the twenty first century, all processes that tend to manage in optimal fashion the abundantly available resources and materials, cheaply or for free – including the most important of these, the workforce - can be described as vernacular. In short, the vernacular is whatever stands peripheral to or outside the global flows of capital and everything that, willingly or not, escapes control of these flows" (Frey, 2010).

Frey's contribution to this process of definition is the notion that architecture history cannot be understood without this economic context, and the observation that whereas vernacular architecture is based on human values, today's architecture is determined by the market. Note also, that Oliver's "dwellings and all other buildings of the people" implies that it is not the *domus*-aspect alone that makes something vernacular. This is where the market-aspect comes in. Apparently, there is room between the homemade and the destined-for-the-market. Let us therefore dig a bit deeper and go to the foundation of Illich' description, i.e. the 1736 Latin text. A translation by consulted linguist Jan van Nimwegen reveals some choices and extrapolations:

> Vernacular, all that is born (originates) at home, is the fruit of the homely; a thing (or: something) that is born (created) for someone and that he does (or: did) not buy;

Moreover, so does his interpretation:

> Something that is born to you that has, as it were, to do with you yourself, your own home.

It is essential though to distinguish between the vernacular and modern interpretation of 'own'. In vernacular, 'own' as adjective is different from the modern individual 'own'. The first is the relation to the home one is part of, whereas the latter is related to the self.

If indeed vernacular designates the inverse of a commodity, van Nimwegen's description must be tested against the definition of commodity. Karl Marx wrote "A commodity is, *in the first place, an object outside us*, a thing that by its properties satisfies human wants, whether, for instance, they spring from the stomach or from fancy, makes no difference" (Marx, 1990) [SdM's emphasis].

It shows that Illich uses the Latin phrase as a springboard for his thesis. The "inverse of a commodity" and "not destined for the market" are Illich' own extrapolations from *"quam non emit"* ("that he does not buy"). In fact, it elaborates on the concept of

alienation in the division of labor by linking alien to commodity. Alien/foreign is directly the inverse of the vernacular mentioned in the Latin text, according to Van Nimwegen's translation. The merit of Illich' extrapolation lies in showing that even the most common commodity still is of alien character, as opposed to a vernacular item. Commodity also relates closely to industrial production and systemization, which explains why many of the characteristics mentioned by Rapoport (see page 373) are positions in the dichotomy of vernacular and commodity. A second merit lies in sharpening the idea into delimitation, where others (including Du Cange) stick to characterization. Thus, a succinct definition is reached.

In this thesis, the interpretation of Illich' definition is sharpened by noting that commodity and market both refer to *supply driven* trade, whereas buying something (as mentioned in the Latin text) can also be a *demand driven* trade. One can pay money for something that is tailor-made, or compensate in kind for something specially built, and still it would be a vernacular situation. The distinction can be made sharper, and thus Illich' idea more refined, by designating vernacular as the inverse of supply driven. This will get us beyond the *domus*-constraint and allow the inclusion of Oliver's "other buildings of the people". A typical example of supply driven building is mass housing built without the involvement of end-users, i.e. without any real and direct demand from the people who will inhabit the building. Mass housing is sold or rented out to people who are willing to accept it as it is, sometimes by lack of better options. The inverse is the demand driven form of housing, which is equivalent to private housing, responding to end user's requirements or at least a specific idea of what people want. We are now at the point where John Turner's distinction of autonomous owner-builders versus heteronomous housing developers in HOUSING BY PEOPLE (1976) fits with the idea of vernacular as the inverse of supply-driven.

In UNMODERN ARCHITECTURE, Hans Ibelings (2004) reflects on the distinction between modernism and contemporary traditionalism and hints at a parallel with supply-driven and demand-driven. In his view, housing construction was for several decennia almost equivalent to mass housing. For economic, technical, and sometimes ideological reasons, developers of mass housing often preferred modern architecture. Once private housing became more influential, more attention went to what inhabitants of the buildings prefer. One of the preferences appeared to be an architecture of something that is already there or could have been already there. Ibeling's observation suggests that modern building is more suitable for the supply-driven, whereas contemporary traditional architecture thrives on demand-driven development.

Van Nimwegen's interpretation is comprehensive and fits with Rapoport's, Oliver's, Frey's, and Illich' descriptions. Moreover, it lies at the heart of the qualities all these authors are concerned with and it is closest to the linguistic derivation from the Latin *vernaculus,* native.

Bearing in mind that the Latin text dates back to 1736 while today's context is highly commercial, a useful term in identifying vernacular is the French (and Dutch) *particulier.* It has no exact equivalent in English but is a nuance between particular and private. An observation by Belgian psychiatrist Dirk de Wachter using *particulier* illustrates the vernacular – commercial dialectic and links it with the idiosyncratic nature expressed in van Nimwegen's interpretation.

> *"Meer en meer gaat in onze tijd het particuliere verloren, het specifieke, het idiosyncratische van elk mens. Nu economie de drijfveer is van alle menselijke domeinen, is de mens verworden tot een radertje in een goedgeoliede machine."* (de Wachter, 2012).

> More and more in our times, the particular/private[1] is lost, the specific, the idiosyncratic of every human. Since economy today is the motive of all human domains, man has become a cog in a well-oiled machine. [Translation SdM].

Following the definition of vernacular as a noun, designating the inverse of a commodity, vernacular as an adjective designates the inverse of commercial. In this thesis, the meaning of vernacular is expressed in a dialectic mode with the words commodity, commercial, consumerism, supply-driven, formalized, and modern.

It should be noted here that the purpose of the dialectic is to create clarity in the debate. Although in the above the designation of vernacular versus modern is sharpened, the division between the two is not a radical one. Amos Rapoport argued in **DEFINING VERNACULAR DESIGN** (1990a) that vernacular is a comparative quality, i.e. a building is vernacular in comparison to another building. A medieval church in a modern city is vernacular, whereas in a medieval village that church would be high style.

Symbiosis is closely linked with this interpretation of vernacular. Symbiosis of people and building is a vernacular situation, a vernacular status. It is the sense in building that, as it were, has to do with you yourself, like your own home. Vernacular then is the quality, the condition, the context, whereas symbiosis is the phenomenon of co-existence, the effect, and the experience.

As mentioned earlier, vernacular is often seen as something of the past. The definitions reviewed in the above however, give no support to that notion. The idea that vernacular is something of the past may have its origin in the emergence of modernism. The *Beaux Arts*-schools were rooted in tradition and taught students to follow the existing styles rooted in proven technology. There was little aspiration for innovation. The industrial revolution however, came with a strong call for innovation, to which modernism responded. With its view towards the future, modernism was a radical break away from tradition and soon became anti-traditional. Novelty and

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[1] Note that the meaning of the Dutch *particulier* is identical to the French *particulier,* whereas vernacular as a word has no etymological equivalent in Dutch.

innovation became the norm and references to traditional (and vernacular) architecture were dismissed as nostalgia and sentimentalism. The segregation of modern from vernacular is still present today and both sides fail to bridge the gap. This is illustrated by an observation made by Hans Ibelings (2004) in UNMODERN ARCHITECTURE about the current emergence of contemporary traditionalism in The Netherlands, a country otherwise known as a Mecca of Modernism. Although for many it may be difficult to reconcile traditionalism and modernism, Ibelings argues that contemporary traditionalism is unmodern, although not necessarily anti-modern. Moreover, he points at a missed opportunity for the justification of this new traditionalism:

> "For many housing consumers, traditionalistic architecture has more style and standing. [...] It cannot be ruled out that this preference of housing consumers is determined mainly by a vague nostalgia for a past they have never known. However, even when this is the case, it still is a contemporary nostalgia, just as the traditionalism is contemporary and not a phenomenon that can be dismissed as 'no longer of this time'. The proponents and practitioners of this traditionalism however, almost never succeed in making the latter convincingly clear" (Ibelings, 2004) [translation SdM].

What Ibelings calls 'contemporary traditionalism' however, is not readily vernacular. The architecture Ibelings describes in both ONMODERNE ARCHITECTUUR (2004) and DE NIEUWE TRADITIE (Ibelings & Rossem, 2009) is marked by regional traditionalism. The presented projects however, are built in a modern market oriented process. It bears resemblance with 'critical regionalism,' a term coined by Kenneth Frampton, which is also not anti-modern. Downton (2009) notes that "at the core of regionalism is an implied critique of the objects and processes of mass-production, mass-society and the modernist worldview," e.g. in (Frampton, 1987), whereas "*critical* regionalism ... while it is critical of modernization, nonetheless still refuses to abandon the emancipatory and progressive aspects of the modern architectural legacy" (Frampton, 1988). Downton noted that there is confusion about the relationship between regionalism and vernacular, because vernacular architecture is bound to its purpose and place and thus is inevitably 'regional' (Downton, 2009). Frampton argues about regionalism and vernacular form: 'Regionalism should not be sentimentally identified with the vernacular. By definition, critical regionalism is a recuperative, self-conscious, critical endeavor, and nothing can be further from the vernacular in the initial sense of the term' (Frampton, 1987).The definition used by Frey and Illich though resolves this confusion as it shows that regionalism is not automatically vernacular.

Summarizing, the relevance of vernacular to symbiosis is present in (the closest literal translation of) the above-mentioned Latin text by Du Cange:

> Vernacular, all that originates at home, is the fruit of the homely; a thing that is created for someone and that he did not buy.

Statement of the Problem

Perhaps the most significant development in the history of architecture is the transition from vernacular to modernism. Mechanization, motorization, industrialization, and commercialization have changed the production of building, its character, and thus the symbiosis. Modernization in architecture required an indispensible change of lifestyle reflected in the instructional question: "How to live modern?" These changes in both people and building have affected their relationship, i.e. their symbiosis. The process of adopting the modern lifestyle continues even today. Examples of the frictions that occur in the process are:

- The call for user-participation in many mass-housing projects is symptomatic of people not feeling connected to a place. Apparently, there is a gap between the developers of the project and those who use it, i.e. the end-users are not involved by default. Participation strategies are often alien to or conflicting with the production process.
- As an effect of industrialization, people migrate from the countryside to the city. Since often too little housing is available, people have to build their own houses, which then results in so-called *slums* and poor living conditions. The rural way of living they bring to the city does not readily fit with the planned city.
- In developing countries, so called redevelopment projects in which the aim is to replace informal settlement and slums with industrial housing, meet resistance from the involved inhabitants. Development strategies meet limited acceptance.
- In developed countries, sustainability is 'hijacked' by the high-tech industry. Of its two pillars recycling and energy-efficiency, the latter is used as a justification for the exclusion of the end-user regarding control over building elements and services, exemplified by the non-operable window.
- In some organizations housed in today's high-style architecture, one can find restrictive policies regarding decoration and personalization of the workspace.
- In modern architecture, the functionalistic concept came with the introduction of 'circulation space', e.g. corridors in apartment buildings. In practice, these spaces often fail to support regular social activities, and appear problematic, unattractive, and unsafe.

As is clear from the above discussion on vernacular, the home is the domain of symbiosis *par excellence*. While functionalism was widely prioritizing utilitarian functions over meaning, anthropologist Amos Rapoport did the opposite and observed in *House Form and Culture* (Rapoport, 1969) that traditional housing may be more acceptable, if not desirable, than is assumed in (then) current development, and consequently recommended it as a field for research. Furthermore, in the same work he saw symbiosis being at odds with rationalization:

"Buildings, as all human endeavors, obey varied and often contradictory and conflicting impulses which interfere with the simple and orderly diagrams, models and classifications we love to construct. The complexities of man and his history cannot be encompassed in neat formulas, although the desire to do so characterizes our age."

Building is an activity that has evolved from creating shelters requiring extensive operation and adaptation by their users to creating buildings today that are fully autonomous. It is known from behavioral sciences that interaction with an object contributes to the sense of attachment to that object (Cerulo, 2009; Csikszentmihalyi & Rochberg-Halton, 1981; R. W. Gibbs, 2006; Proshansky et al., 1983). Industrialization and the application of high technology however, have led to a marginalization of human involvement in construction, operation, and demolition of buildings. Therefore, the relationship of people and their buildings, the *symbiosis*, is affected. In extreme cases, the logic of building has taken on a life of its own and has lost much of its connection with the building's occupants. Although architects and behavioral scientists have noticed this disconnection, little is known about how the connection, i.e. symbiosis, works and how it has evolved in the transition from vernacular to industrialized commercial building and beyond. Since objects have a determining effect on the development of the self (Csikszentmihalyi & Rochberg-Halton, 1981), it is crucial to map the relationship that exists between people and things, how it works, and what implications it has.

In addition to these observations and as a continuation of the mechanization and systemization process already spanning many centuries, our relation with the world is now encountering the phenomena of virtual realities and augmented reality. The current build-up of the ubiquitous computing will undoubtedly further affect the symbiosis. Many human activities in which buildings are involved are now being replaced by background machine action (augmented reality) or relocated to virtual environments.

The symbiosis investigated in this thesis lies at the interface between studies on human behavior and studies on the built environment, i.e. anthropology, psychology, and architecture. None of these disciplines however, seems to explicitly deal with symbiosis. This is due to a fundamental difference in focus between natural sciences and human sciences, illustrated by the contrast of nature and nurture. The nature-focus concurs with the idea that culture is only a thin layer over the many natural causes of phenomena, whereas social sciences mainly follow the nurture approach in which culture is the dominant factor in human behavior (Westbroek, 2012). Architecture, taught at institutes of technology, is on the side of natural sciences and dominated by the nature approach. Philosopher Edgar Morin however, argues that the earth's identity and human policies cannot really be studied without a way of thinking that spans disjoint notions and compartmentalized thinking (Morin, 1993), in other

words, nature and nurture are complementary and antagonistic, which implies the whole can only be understood through the relation of the two. This is what geologist Peter Westbroek considers typical of a new *symbiotic* worldview, as the latest successor of geocentrism, heliocentrism, and the anthropocentrism of modernism (Westbroek, 2012).

One of the questions in this thesis is about how people have kept up with the evolution of architecture. This evolution includes:

Primitive shelter

Vernacular architecture

Classical architecture

Modern architecture

This evolution leads to the following hypotheses:

These stages of architecture evolution are visible in architecture.

These stages of evolution co-exist today.

The symbiosis of people and building is of different character in the respective stages, which have their own sets of rules and represent different and sometimes conflicting interests.

This evolution may have been too rapid for our symbiosis with building.

The transition from one stage to the other comes with changes in human behavior and in architecture that range from smooth to abrupt, and thus can cause stress in both. Transitions can be successful, but also fail.

An illustration of the tensions that occur between technological development and human agency is the following. Architecture is predominantly about buildings, physical requirements of occupants, and aesthetics. In architectural planning for example, when it comes to quantitatively matching humans and design, many designers rely on Ernst Neufert's BAUENTWURFSLEHRE (Neufert & Kister, 2009). It provides meticulous information on what spatial dimensions are required for each human activity. In engineering, comfort is commonly defined in terms of ergonomics, temperature, humidity, and lighting. A qualitative match of man and building is sought in psychological comfort and architectural aesthetics, both mainly dealing with spatial and visual qualities. Canter argued that in the architecture and engineering disciplines, thinking about human interaction with buildings is marked by determinism, i.e. a certain built environment is thought to go with a certain human behavior (Canter, 1974). Architects, it seems, focus on how to accommodate humans and their behavior, whereas bodily interaction with building and the consequent attachment to place, are rarely considered. Moreover, contemporary high-tech building design tends to exclude

man from daily operation. Doors open and close automatically, while building management systems (BMS) are in control of temperature, air quality, and lighting.

The Untouchable Building Syndrome

In order to bring the above together in one comprehensive problem statement, three phenomena were identified that are emblematic of the trend as a whole.

1. *Star-architecture*. Architecture as known from the magazines chiefly deals with the work of famous 'star-architects' and is less concerned with everyday life aspects of buildings.
2. *Slums.* One billion people live in sub-standard housing or 'slums', trapped between traditional living and the modern city.
3. *High-tech autonomous buildings.* Despite what technology nowadays affords, people in modern building are not necessarily enjoying more control over their situation.

In this thesis, these three phenomena are united under the *Untouchable Building Syndrome*.

The Cambridge Advanced Learner's Dictionary defines *untouchable* as:

> Verb: not able to be punished, criticized, or changed in any way.
> Noun: a member of the lowest social group in Indian society.

Star-architecture. Untouchable as a verb in the sense of not able to be criticized is typical of many a star-architect's work. Among architects, it is near to impossible to criticize it, since discussing the notorious technical and practical issues is considered vulgar. The inability to be criticized is known from Hans Christian Anderson's short tale of The Emperor's New Clothes. The inability to be changed is typical of the same category of architecture. History has it that pope Pius II Piccolomini was so impressed by the beauty of the cathedral of Pienza, Italy, he issued a decree stating no changes of any kind should ever be made, as to preserve the magnificent image.

Slums. Untouchable as a noun refers to quite the other end of architecture: informal settlement. One of the research projects in this thesis is located in Dharavi, a neighborhood established by *dalits* in Mumbai, India. As became clear in the case study (chapter Slum Improvement, page 261), slums are the result of the inability of the planned city to sufficiently absorb migrants. Most cities in their ambition to 'beautify' consider the architecture of slums foul and untouchable in itself.

High-tech autonomous buildings. In addition, the meaning of untouchable as an adjective characterizes the phenomenon of buildings in advanced societies requiring less and less active handling by humans. Today, buildings become so autonomous that in order to function as programmed, physical tactile contact with their users is avoided. Lighting switches on automatically and doors open and close without the help

of the human hand. User-building interaction is evolving towards less physical contact with occupants, and more sensing and responding by technical systems. The fixation of fenestration in order to maximize the efficiency of the air conditioning is emblematic of the regression of user-building interaction. However, the possibility of opening and closing windows and shutters *at will* is an important part of experiencing psychological comfort.

Need for a Conceptual Framework

Despite being aware of these problems, professional disciplines seem not capable of effectively sorting them out. They have conflicting interests, do not have a genuinely shared ambition, or lack sufficient knowledge of the forces and currents that eventually control their success. This thesis aims at mapping these forces and currents and putting them in a conceptual framework. Since the end-user and his symbiosis with the building is where it all comes together, the symbiosis is the logical focal point around which to build theory. By doing so, it is possible to identify phenomena in different fields that will reveal new interdisciplinary patterns and trends.

The current lack of such a focal point and a conceptual framework of prevailing trends is the problem this thesis aims to address.

Once it is clear what the mechanisms of symbiosis are and how it is subject of trends, it will be possible to formulate strategies that put the end-user in the center again. In other words, it will be possible to respond to the Untouchable Building Syndrome.

Philosophical Approach

There is a wide range of attitudes towards the nature of knowledge and the way we do research. Roughly, these attitudes can be grouped into (or between) two camps, the *positivists* and the *relativists*. The following brief comparison between these two divergent positions, as explained by Nicholas Walliman (2004), is made here in order to state the philosophical approach of this thesis.

Positivism maintains that in science things must be observable and measurable and that the researcher takes a detached and neutral position from the object of research. Logic and the relation of cause and effect are important concepts, and some believe that any phenomenon can be explained in a logical way if only enough knowledge about it is gathered. Eventually, all phenomena and their interactions will be understood (generalization). Positivism assumes that everyone shares the same reality, not one of different worlds with different rules. This works well in research on inanimate objects and forces, although the complexity in reality makes reliable predictions impossible, e.g. long-term weather forecast.

Relativism on the other hand, maintains that we are so entangled with the rest of the world and that in the process of doing research, it is impossible to be a complete outsider and to observe things impartially. Therefore, even in the 'hard' sciences one

must be aware of cultural, social, commercial, and sometimes religious circumstances. Since these factors change over time, it is impossible to come to a final set of 'rules of the game' that explains the whole world order. Relativism assumes that every individual has his own perception of the world, and that we can only look on the world from within since we are within. Since life and society are complex, it is not possible to come with a simple and uniform explanation or neat formula. Consequently, generalization from studied cases is considered dangerous by relativists.

Both positivists and relativists aim at creating a correct image of the world around us. This image however is inevitably a construct, and the *constructivist* branch of philosophy therefore holds that reality is inevitably an invention. In *The Invented Reality* (Watzlawick, 1984), a collection of essays on the subject of constructivism, "experts from various fields explain how scientific, social, individual, and ideological realities are invented (constructed) [. They are the] result of the inevitable need to approach the supposedly independent reality 'out there' from certain basic assumptions that we consider to be 'objective' properties of the real reality, while in actual fact they are the consequences of our *search* for reality." In this thesis, the philosophical approach is mainly that of relativism and the grounded theory presented is indeed an invented one. It aims at offering a perspective that will help identify relations between phenomena. The perspective offered here is an aid for recognizing patterns, not a set of rules that exhaustively explains them. The methods used in investigating the topic however, do reflect a certain positivist attitude.

Elements to be Investigated

The basic idea of this thesis is to develop Symbiosis of People and Building as a theoretical tool. For this, insights have to be put in a model, and then the model must be tested, adjusted, tested again, et cetera. The first version of the model is built of what is known from literature. The tests will consist of using the model in fieldwork research. From there, the process of refining the model will go several times through the cycle of literature study and fieldwork observation.

In order to model what the symbiosis is, how it works, and to see how the model can be applied in studying the built environment, factors that afford the symbiosis as well as phenomena that are based on it, have to be identified. Note that the latter are manifestations of symbiosis. In order to test the symbiosis model, symbiosis will be investigated under changing conditions. For this, we will look into the effectiveness of the model in describing the transitions from one stage to the other in the above-mentioned range from primitive shelter, vernacular architecture, to modern architecture.

Dimensions

In this thesis, the elements of research are the factors that afford the symbiosis as well as the trends that influence symbiosis. The process of identifying, collecting, and categorizing these elements, will lead to a refinement of the symbiosis concept. When investigating the relationship of people with their buildings, the following aspects have to be investigated: (1) properties of people; (2) properties of buildings; (3) the role of the relationship in the social context; and (4) formal structures affecting the relationship. In this thesis, these four categories are the *dimensions of symbiosis*. The chapter Dimensions of Symbiosis (page 41) will investigate and collect the elements that are part of the respective dimensions.

	The ... dimension	*is about ...*	*and goes under the title ...*
1.	Personal	People	People and Symbiosis
2.	Material	Building	Building and Symbiosis
3.	Social	Other people	Society and Symbiosis
4.	Formal	Order	Formality and Symbiosis

Table 1. Dimensions of Symbiosis. The elements of research will be grouped in these categories.

Hypotheses

This thesis will test the idea that the relationship of man and building is a case of symbiosis, with building seen as a life form in symbiosis with people.

In order to survive as a phenomenon per se, the symbiosis must have an internal beneficial logic, and must be beneficial to its context as well. Changes in these benefits mark the transition from vernacular to high-tech architecture.

Symbiosis is based on interdependence. The transition from vernacular to high-tech architecture is marked by changes in the nature and structure of this interdependence.

The changes in symbiosis as they occur in the transition from vernacular to high-tech architecture will show certain patterns and trends.

Evidence of the existence of this symbiosis is present in external phenomena that explicitly deal with this symbiosis.

A consequence of the symbiosis is that people can be identified with the building they live in, vice versa. Social order is thus linked to the order of the built environment. Therefore, the symbiosis is a tool in keeping order in society.

When people migrate, they will bring with them their most familiar way of living. Unless others provide housing, people will build a house that recreates their symbiosis.

Active people-building interaction contributes to tolerance in users, which helps them handle variations in levels of comfort. Therefore, the ability to adapt requires regular

exercise and exposure to a stress factor. Since highly automated buildings afford less kinetic interaction, they fail to sustain people's tolerance regarding comfort, i.e. so called 'smart buildings' are not necessarily perceived as more comfortable.

Symbiosis is a social relation. In vernacular environments, the building is member of the household or community, whereas in commercial conditions, the building is an individual and consequently relationships are formal.

The sense of self is stronger in commercial environments where ownership requires a single, one-on-one relationship between two clearly defined and delimited entities. In vernacular environments, individual ownership (if at all exercised) is more diffuse and the concept of identifying something or somebody as an *individual* is less common.

Research Questions

Is the relationship of people and building indeed a symbiosis?

What makes the symbiosis?
> What properties in people afford symbiosis?
> What properties in buildings afford symbiosis?
> How is the symbiosis reflected in architecture?
> How is symbiosis used in society?

How did the symbiosis of man and building evolve in the transition from vernacular to modern environments?
> What is the role of symbiosis in a vernacular environment?
> What is the role of symbiosis in a modern environment?
> What happens to symbiosis in an environment that is in transition from vernacular to commercial?
> Can issues that occur in the transition be identified as changes in the symbiosis? In other words, are failures in development projects linked with disruption of symbiosis?

Life and death of the symbiosis: since a symbiosis is a combined life form, what happens when one of them dies/is killed?

Man	Building
Conception	Design
Birth	Construction
Life	Reconstruction
Death	Demolition

Is in vernacular and modern settings, the concept of 'Self' of similar meaning?

Which trends affect symbiosis?

Which trends support symbiosis, and which do not?

Definition of Terms

Abstraction ... "is the driving force in urbanization: detachment from the soil, liberation from earthy conditions" (Fiedler, 2014).

Adaptation: "A quantitative shift in the distribution of judgmental or affective responses along a stimulus continuum, as a function of continued exposure to a stimulus" (Wohlwill, 1974).

Adjustment: "A change in behavior which has the effect of modifying the stimulus conditions to which the individual is exposed." (Wohlwill, 1974) following Sonnenfeld (1966).

Affordance: "a combination of physical properties of the environment that is uniquely suited to a given animal – to his nutritive system or his action system or his locomotor system. [...] If there is information in ambient light to specify substances, solid objects, and surface layouts there is information to specify their affordances for eating, for manipulation, and for locomotion, that is, for behavior" (Gibson, 1977).

Building: In this thesis, the word *building* is often used without article. It thus can mean either the verb or the noun. This is done in order to avoid the wordiness that comes with mentioning both meanings every time again. In addition, as both the action and the thing are part of symbiosis, circumventing the linguistic distinction is a way to express its dynamic character. "The word 'building' contains the double reality. It means both 'the action of the verb BUILD' and 'that which is built' – both verb and noun, both the action and the result. Whereas 'architecture' may strive to be permanent, a 'building' is always building and rebuilding" (Brand, 1994).

Client: "A customer or someone who receives services" ("Cambridge English Dictionary & Thesaurus," n.d.). In this thesis, *client* is used in case of demand driven interaction, and *consumer* for supply driven trade. (See also *Consumer* and *Customer*).

Consumer: "A person who buys goods or services for his own use" ("Cambridge English Dictionary & Thesaurus," n.d.). In this thesis, *consumer* is used in case of supply driven trade. See also *Client*.

Consumerism: "is a social and economic order and ideology that encourages the acquisition of goods and services in ever-greater amounts. Early criticisms of consumerism are present in the works of Thorstein Veblen" ("Consumerism," 2014). See also (Veblen, 1899).

Commercial: Made for the market. Commercial designates the inverse of vernacular; see also the discussion in Theoretical Framework (page 15).

Commodification: "a somewhat Marxist idea, referring to the way that market values can replace other social values, or the way a market can replace a communal system" (Rushkoff, n.d.) (See also: Vernacular).

Commodity: An object that, besides its use value, has exchange value. "A commodity is, in the first place, an object outside us, a thing that by its properties satisfies human wants, whether, for instance, they spring from the stomach or from fancy, makes no difference" (Marx, 1990).

Customer: "A person who buys goods or a service"("Cambridge English Dictionary & Thesaurus," n.d.). Note the market context implicated by the word *buys*. As in this thesis a distinction is made between demand and supply driven trade, the use of customer is avoided as it is too ambiguous. In this thesis, *consumer* is used for supply driven trade, and *client* for demand driven situations.

Demand driven: A situation in which something is produced with the intention to meet a certain demand from a known client. (cf. Supply driven).

Determinism: The idea that human behavior and the actions of the user of a building are predictable and that every event has a cause (Hill, 2003).

Disposition: A natural tendency to do something, or to have or develop something.

Domicide: "[The] deliberate destruction of the home. Briefly, domicide is the murder of the home. [...] More formally, domicide is defined as *the deliberate destruction of home by human agency in pursuit of specified goals, which causes suffering to the victims."* (Porteous & Smith, 2001).

Domotics: is a composite of the Latin word *domus* and *informatics*, or a contraction of *domestic robotics*, and it refers to *intelligent houses* meaning the use of the automation technologies and computer science applied to the home.

Embodiment: Bodily internalization of movements, operations, actions, unlike the conscious execution. Skills can be seen as embodied tacit knowledge, since "...we might be able to describe them, we cannot explain exactly what we do when we go about these tasks" (Dourish, 2001).

Existential: Something that relates to our sense of existence, unlike instrumental, which refers to logical, practical, and technical issues.

Family, Extended –: Family including parents, spouse, siblings, aunts, uncles, cousins, nephews, and nieces, i.e. all family members that are related through blood lines. The extended family can occupy several homes and does not necessarily form one household.

Family, Joint –: A family consisting of multiple generations, living under one roof, sometimes subdivided into several households. For example an elderly couple, their children with spouses, and their grandchildren. Traditionally, sons stay with the family while daughters move to the joint family of their husbands. For this reason, the birth of a son is an important guarantee for future support of the elderly. In the matriarchal society found in Kerala in South India, the opposite applies.

Family, Nuclear –: A family / household consisting of one couple and their children (if any). This family format became popular with the industrialized production of housing, which required standardization. The nuclear family is the smallest possible family unit, and the most profitable format in mass housing.

Home: "Home is [...] a spatial, psychosocial centre in which at least a portion of an individual's or a group's identity resides." (Porteous & Smith, 2001)

Interaction: in this thesis, man-building interaction mainly means a physical, kinetic action, for example opening a door, changing partitions, or adjusting blinds.

Kacca: A *kacca* house is built of mud and organic material, unlike the *pucca* house, which is built of solid and more permanent materials like brick, stone, timber, and cement. A more elaborate description of the dialectic of *Kacca* and *Pucca* is available in the chapter '*Kacca* and *Pucca*', on page 107.

Kinesthesia: "Sensing body motion haptically by detecting the movement of joints and muscles through the entire bodyscape" (Bloomer & Moore, 1977).

Man – people. In this thesis, 'man' is mostly to be read as 'the human race' or 'a person of either sex.' It is gender neutral, like *Mensch* in German, and its plural is 'people'.

Minergie: indicator of energy-efficiency of buildings in Switzerland. The *Minergie*-label is awarded to projects by the *Minergie* association. Real estate business uses the label as a selling point.

Modern: can mean either contemporary, or part of a certain era. There are several modern periods in history, the first starting with the Renaissance. The adjective 'Modern' (with capital M) commonly refers to Modernism as the period in architecture history starting around 1910. In this thesis, modern is interpreted as the inverse of vernacular, so as part of the overall movement, not specifically Modernism. Modernity has a globalizing character. Its perspective is on what is out there, both in geographical sense and in time (future), whereas vernacular tends towards origin and source. Since in this thesis vernacular is considered something of all times, modern cannot be limited to contemporary. In cases of technologically state-of-the-art buildings, the word 'high-tech' is used to avoid confusion with Modern.

Proxemics: The interrelated observations and theories of man's use of space.

Pucca: A *pucca* house is built of solid and more permanent materials like brick, stone, timber, and cement, unlike the *kacca* house that is built of mud and organic material. A more elaborate description of the dialectic of *Kacca* and *Pucca* is available on page 107.

Regionalism: Architecture typical of a certain region. It reflects local tradition and best practice, unlike an international style.

Self-conscious: The kind of architecture in which individual expression of the builder/designer is clearly present (Alexander, 1964).

Slum: " is an area that combines, to various extents, the following characteristics: inadequate access to safe water; inadequate access to sanitation and other infrastructure; poor structural quality of housing; overcrowding; insecure residential status" (UN-Habitat, 2003).

Social capital: "Whereas physical capital refers to physical objects and human capital refers to properties of individuals, social capital refers to connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 2000).

Supply driven: A situation in which something is produced with the intention of bringing it on the market and selling it to whomever is interested, i.e. not on order. (cf. Demand driven).

Technium: designates "the society and culture of tools". It is akin to what the Germans call *Technik* and the French *technique* as opposed to *technologie* (Kelly, 2010).

Un-Self-conscious: The kind of architecture based on tradition and best practice developed over many generations. It holds no role for the individual expression of the builder/designer (Alexander, 1964).

User: "The **passive** user is predictable and unable to transform use, space, and meaning. The **reactive** user modifies the physical characteristics of a space as needs change but must select from a narrow and predictable range of configurations largely defined by the architect. The **creative** user either creates a new space or gives an existing one new meanings and uses" (Hill, 2003).

Vernacular: "[Vernacular] ... designates the inverse of a commodity. [...]'Vernacular' means those things that are homemade, home-spun, homegrown, not destined for the market, but that are for home use only" (Illich, 1983).

Summary

The quality of how people relate to buildings has all to do with the degree of life of the built structure itself, as argued by Christopher Alexander in his lifelong oeuvre. Alexander provides methods and strategies for achieving a built environment that is alive. Much of today's building however, goes a different direction; one that is no longer based on the live quality. This thesis investigates the forces and flows that control this shifting away from live building.

Three phenomena emblematic of this shift are:
1. *Star-architecture.* Design that cannot be criticized.
2. *Slums.* Architecture by 'untouchables'.
3. *High-tech autonomous buildings*, making control by human beings redundant.

In this thesis, the *Untouchable Building Syndrome* is the container of these three phenomena. In order to unravel the Untouchable Building Syndrome, this thesis builds on Alexander's notion of live building by extending it to a combined life form, the *Symbiosis of People and Building*.

Alexander's work is a response to developments of modern architecture, in a dialectic that continues today. The debate includes statements that Alexander finds himself, or has placed himself, outside the architecture discourse. The aim of this thesis is to build a conceptual framework for this dialectic, the co-existence of live and non-live architecture.

Literature and Theory

It follows from the structure mentioned on page 28 that there are five domains of theory to investigate: symbiosis + four dimensions. The first domain is symbiosis as a concept for the people–building relationship. It comes before the domains of the four dimensions.

Symbiosis as Concept for the People–Building Relationship
This part will focus on the use of the term symbiosis in relation with architecture by other authors, as well as on the notion that buildings can be alive although they are inanimate objects. In addition, the more general symbiotic worldview as in Lovelock's Gaia-theory will be discussed, as well as symbiosis as embodied dealing with the world.

People and Symbiosis
The investigation of properties in people will start with basic concepts such as senses and perception in psychology, sociology, anthropology, architectural history, and then move to more detailed aspects like meaning, comfort, learning processes, embodiment, bonding, operation, personalization, familiarization, individualization, and disconnection, coping strategies, and reflection of the self in the habitat.

Building and Symbiosis
The investigation of properties in buildings is about how buildings afford and reflect the interaction with people as in for example Christopher Alexander's work on live architecture and Carel Weeber's *'Wilde Wonen'*.

Society and Symbiosis
The role of symbiosis in the social context is about building as an object in social behavior and exercising power. In other words, it is about building and the balance of autonomy and heteronomy.

Formality and Symbiosis
Besides the social context, people and buildings are also subject to all kinds of legal, regulatory, and financial arrangements. Formality plays a major role in the transition from vernacular to the modern economy, as well as in the economics of 'development'. In high-tech environments, building codes, by-laws, and policies regarding energy consumption have an impact on the design of buildings and thus on the symbiosis. Commodification, a key mechanism in capitalism, similarly affects symbiosis. Since most countries have nowadays adopted capitalism as the only feasible way of organizing their economy, people-building symbiosis inevitably has to be discussed in the context of commodification.

Symbiosis

In **Poetics of Space**, Gaston Bachelard (1997) explains that the house is the entity that affords the solidarity of memory and imagination. This affordance is rooted in the attachment that comes with inhabiting a place and thus, the chief benefit of the house is that it allows the inhabitant to give meaning to things, to freely dream and daydream. Bachelard considers man's relationship with the house "one of the greatest powers of integration for the thoughts, memories, and dreams of mankind". It is what keeps man together in a bond so strong that "without it, man would be a dispersed being. [...] It is like body and soul." Bachelard suggests to consequently giving psychoanalysis an auxiliary named *topoanalysis*.

In **The Timeless Way of Building,** Christopher Alexander (1979) describes his quest to capture the universal quality that is characteristic of buildings, objects, and spaces that are felt to be 'alive' by the common public. Alexander identifies this quality by the degree of *life* experienced when comparing two (or more) objects. **The Timeless Way of Building** also reveals Alexander s concern about the loss of *life* in today's architecture, which is why in **A Pattern Language,** Alexander and others (1977) set out a system in which patterns describe how to achieve this quality of *life* in our environment.

One of Alexander's methods of determining the degree of life in a sample is the *Mirror of the Self* test, introduced in **The Phenomenon of Life** (Alexander, 2002c), in which the observer decides which of the compared samples is more a reflection of the observer's *Self*. The idea bears similarity with Theodor Lipps's notion of *Einfühlung*. Lipps characterized empathy as the objective enjoyment of 'self ' in another person or object. He suggested that the sense of beauty was dependent on the extent to which the beholder could detect his own private identity in the activities of another person or object (Bloomer & Moore, 1977). The concept of life in a building is thus taken to an existential level. The idea of symbiosis is recognizable in this *Mirror of the Self* as it considers the observer's self-awareness related with the object i.e. when the observer experiences symbiosis, the object is alive. With these methods, Alexander eventually comes to a shortlist of fifteen fundamental properties of items that are alive.

Alexander takes the distinction between alive and less alive further in **The Process of Creating Life** (Alexander, 2002d), where he adds the dimension of time to the properties and thus comes to life generating processes. As for the distinction between traditional and modern production, Alexander elaborates into generated structure versus fabricated structure and the processes that create such structures.

The **Luminous Ground** (Alexander, 2002b), is where Alexander takes the idea of life in architecture again one step further up. In an encompassing concept of a metaphysical *One*, Alexander unifies all the fundamental properties of **The Phenomenon of Life** and the characteristics of **The Process of Creating Life.**

Although Alexander's work is marked by an emphasis of 'life' and 'alive', the notion of symbiosis as used in this thesis is not found as such.

The notion that encompasses Alexander's books is that of order as opposed to entropy. *The* PHENOMENON OF LIFE, THE PROCESS OF CREATING LIFE, and THE LUMINOUS GROUND are parts of the four-volume NATURE OF ORDER. Like *A* PATTERN LANGUAGE, all these deal with the notion that life is marked by patterns and order. In WHAT IS LIFE? Erwin Schrödinger (1967) explains that contrary to the tendency of physical matter to equalize differences and reach a state of thermodynamic equilibrium (entropy), "living matter evades the decay to equilibrium" and feeds on "negative entropy" by extracting 'order' from the environment. It is essential however, that this order is maintained by the life form itself. According to Alexander, a certain order makes the difference between alive and non-alive objects. The difference in order coincides with the distinction between vernacular and modern design.

Alexander's dissatisfaction with modernity is evident in all of his work and people in many fields shared this dissatisfaction. Besides the obvious Post-modernists, architects sought new approaches that would afford more human-centered architecture. In Japan, where nationalist sentiments highlighted detachment from traditional philosophies, various architects worked on designs that would somehow reconnect construction to life. Architect Kisho Kurokawa in particular developed a philosophy of symbiosis.

In FROM METABOLISM TO SYMBIOSIS (1992) and THE PHILOSOPHY OF SYMBIOSIS (1994), Kisho Kurokawa presents a philosophy that puts Symbiosis as a response to Modernism. In so far as an explicit definition of symbiosis can be found in these two works, Kurokawa refers to his teacher Benkyo Shiio, principal at Tokai Gakuen in Nagoya and head of the Zojoji temple complex in Shiba, Tokyo. According to Kurokawa (1994), Shiio coined the term symbiosis in 1923. Shiio began a *Zaidan Hojin Kyosei Kai* or, in Kurokawa's translation, a "Foundation for Symbiosis". (Note that *Kyosei* equals Symbiosis here). In the same paragraph however, Kurokawa remarks: "In Shiio's Buddhism of symbiosis, he [Shiio] reads the characters *kyosei* as 'living together', or coexistence." Since the term symbiosis seemingly did not come from Shiio, and co-existence is a concept already long taught in Buddhism, it is contradictory that a generic term like symbiosis was coined indeed in 1923, and indeed by Shiio. Adding to the confusion is the following meager reference to biology. Kurokawa's choice of 'symbiosis' to express relatedness is motivated with "This type of symbiosis, which includes opposition and competition, is often seen in the world of living things. This is one reason that I selected the term 'symbiosis' rather than coexistence, harmony or peace." (1994). It is unclear why Kurokawa finds coexistence and harmony not sufficient, and it therefore remains unclear why and how Kurokawa distinguishes symbiosis from coexistence.

In the same two books, Kurokawa gives his view on how the architecture of the machine age is developing into architecture of the age of life. In brief, he describes how

the use of machines forced man to adopt strategies that divided production into machine-manageable steps and thus required a new paradigm, commonly known by Karl Marx's term Division of Labor. This division, and its subsequent uniformity, abstraction, fragmentation, and alienation, is what makes modernity detached from other aspects of life. In order to reconnect, architecture should focus on life, and all its diversity.

First, Kurokawa observes that "The machine symbolizes Eurocentrism" (Kurokawa, 1992), with which he meant that because of the invention of the steam engine, and subsequently the automobile and airplane, Europe for a long time was the center of machine development. Eurocentrism was symbolic of the worldwide adoption of the machine and referred to people around the world looking at Europe for novelties. Nevertheless, according Kurokawa (1992) "The Modern architecture born in this machine age - the universal, 'International Style' – was an attempt to dominate and control non-Western countries."

More relevant to this thesis however is Kurokawa's observation that the machine symbolizes *logocentrism*, which he explains as "according to which there is one truth for the entire world, its ideal form verified through the scientific logic of the human intellect" (Kurokawa, 1992). With this, Kurokawa links the machine to positivism and Cartesianism. Both relate to atomization, against which Kurokawa argues more specifically. Eventually, THE PHILOSOPHY OF SYMBIOSIS (Kurokawa, 1994) is an essay promoting the relevance of context. Kurokawa presents symbiosis as the inverse of dichotomy and the binomial opposition of dualism, and instead considers it a continuum in which everything relates to everything. It is fundamentally different from amalgamation, eclecticism, compromise, and harmony. Kurokawa mentions two conditions necessary for symbiosis. One is reverence for the sacred zone between two elements, as expression of mutual respect. The second is the presence of intermediary space, i.e. the overlap where negotiation between elements takes place. An example is the typical open corridor found in Sukiya style architecture. It resembles the Western veranda. This kind of intermediary space is an important feature in reducing the sense of alienation caused by the modern segregation of urban space into private and public (Kurokawa, 1992).

In this thesis, the term symbiosis is used the same way as in biology, where it means a coexistence/cohabitation of organisms, from which both benefit. Symbiosis as in lichen is composed of other life forms (the symbionts) i.e. algae and fungi, and is characterized by its appearance as a third phenotype with properties that cannot be recognized from those symbionts. The symbiosis then is a phenotype per se. In a similar way, the symbiosis of people and building is a phenotype of *dwelling*[2]. In addition, both the noun and the verb have this phenotype quality. Symbiosis in

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[2] 'Man's relation to locations, and through locations to spaces, inheres in his dwelling. The relationship between man and space is none other than dwelling, strictly thought and spoken.' (Heidegger, 1997).

Kurokawa's philosophy does not identify such encompassing phenotypes. It resembles though the relationship of *yin* and *yang*, known from Taoist philosophy. Although the two poles are each other's inverse, their coexistence and interdependence is where the encompassing principle of *Wurli* is found (translated as 'ultimateness' (Feng, 1952)). Kurokawa seems to use symbiosis to express *wurli.* In another example, Kurokawa refers to a Japanese garden as the symbiosis of 'autonomy of the parts' and the 'order of the whole'. Symbiosis is used here to express composition.

Metabolism is the term Kurokawa introduced when he founded the Metabolism Movement in 1959. Of the main points of its philosophy mentioned in (Kurokawa, 1992), the following are relevant to this thesis:

- The revival of elements lost or overlooked in Modern architecture, such as historical traditions, local flavor, and the nature of place.
- An emphasis not only on the whole but also on the existence and autonomy of parts, sub-systems, and sub-cultures.
- Cultural identity and regional character are not necessarily visible. Just as information in human beings is passed on to future generations through DNA, tradition should be valued for its invisible philosophies, lifestyle, and aesthetic codes. [...]
- The architecture of metabolism as the architecture of temporariness. A dynamic balance expressed by Buddhism's concept of impermanence as an alternative to the Western aesthetic ideals of the universal and the eternal.
- Considering architecture and the city as open systems in both time and space, like living organisms.
- *Diachronicity*, the symbiosis of past, present and future; and *synchronicity*, the symbiosis of different cultures.
- Sacred, intermediary zones, ambiguity, and the indefinite, which are the special features of life.
- Valuing relation more than reality itself.

Perhaps the idea of *Diachronicity* comes closest to the first goal of the Metabolist movement, which is the appreciation of regenerative qualities in architecture and urban planning. Instead of architecture frozen once a building is completed, Metabolism aimed at the process in which buildings change over time. It sought to include past, present, and future in architectural space. In that sense, it saw buildings as living objects. Decorative elements and symbols referring to traditions and the past play a role in Diachronicity, unlike their rejection by Modernists. It also sought an architecture that would stimulate the people living in it to participate in the regenerative process. This comes close to the idea of symbiosis of people and building, but surprisingly it is not found in the many examples of symbiosis Kurokawa brings forward.

Kurokawa characterizes modern architecture as divorced from tradition and artisanship, produced of the products of modern industry, and aiming at the creation of an industrialized society. With it came the segregation of urban space into public and private, at the cost of communal property. Roads, lavatories, and wells were similarly divided into public and private property.

Another concept supporting the symbiosis approach is described in **HOW BUILDINGS LEARN** by Steward Brand (1994). In order to describe the practice of design and build, Brand uses the analogy of life in nature. The architectural design process in the industrial paradigm is mostly limited to the stages of design and build, or in analogy with nature: conception, and birth. The lifetime that comes after birth is hardly considered part of the architectural process. The *learning* buildings however, are being changed and adapted through time. They have a life and the main incentive in the learning process is use, which brings about the idea of user-building symbiosis.

In **DE ONTDEKKING VAN DE AARDE** (The Discovery of Earth), geologist Peter Westbroek (2012) describes the emergence of the symbiotic worldview. In a 1795 publication, geologist James Hutton argued that the earth as a whole is alive and in fact a giant organism. This idea was too revolutionary for its time however, since most geologists considered it impossible for biology to have any influence on geologic processes. Another hurdle was the segregation into two scientific camps, almost parallel to two seemingly independent categories of rocks: one of volcanic origin (Plutonism), the other from sedimentation in the oceans (Neptunism). The Neptunists held that rock resulted from minerals suspended in water (as marine life) and was formed in a process of sedimentation. Plutonism however held that for example basalt was made of magma erupting from the earth's core, then weathered, and eroded into smaller particles, which as sedimentation returned to the earth's core. Plutonism prevailed for many decades. Today, Neptunism and Plutonism are unified, since it is known that minerals like limestone are created by organic life. Part of sedimentation therefore is the residue of organic life on the surface. Moreover, the size of sediment packages on the ocean floor is so big it has an influence on plate tectonics and thus is part of the Plutonist cycle.

The work of James Hutton was a major stepping-stone towards James Lovelock's Gaia hypothesis, which proposes that organisms interact with their inorganic environment in a self-regulating system maintaining the conditions for life on the planet. This apparent symbiosis of animate and inanimate objects is the core of what Westbroek describes as Earth System Science. In this vision of earth as a coherent system, the sharp distinction between life and not-life cannot exist. Although the geosphere, the hydrosphere, and the atmosphere are all inanimate, they all bear deep traces of animate life and biologic activity. All three are engaged in a continuous interplay with the biosphere (Westbroek, 2012).

As mentioned in the description of the Gaia hypothesis, a critical principle for a life form is to maintain the conditions that afford its existence. The stabilization of the internal environment of each individual is called *homeostasis*. As for the complexity of keeping this balance, Westbroek refers to a theory formulated by Sebastiaan Kooijman, professor of theoretical biology. Inside a single cell, many processes can be distinguished that are part of its overall metabolism. All these detailed processes can be simplified into cause-and-effect relationships, represented by arrows. Since they are simplifications, each arrow would also represent a degree of uncertainty which, when combined with the uncertainty of the others, would result in a worthless overall model. Instead, Kooijman's theory zooms out from the molecular level. The myriad of actions and reactions in the organism's metabolism appear to comply with a limited set of coherent rules. When in a model a supply or a flow changes in size or direction, every other component of the model has to adapt. As soon as the organism does not comply with this basic rule, it will die (Westbroek, 2012).

Whereas Alexander's work as discussed on page 36 contains detailed descriptions of many patterns and processes that afford life in architecture and thus afford symbiosis, this thesis aims at generating a model for the symbiosis of people and building and identify trends that mark the transition to modernity.

Dimensions of Symbiosis

People and Symbiosis

Perception

The five senses commonly known from the classification by Aristotle are sight, hearing, taste, smell, and touch. In addition, touch was later subdivided into temperature (thermoception), kinesthetic sense (proprioception), pain (nociception), balance (equilibrioception), and acceleration (kinesthesioception). When opening a door for example, we perceive its heaviness through its acceleration and its sound. We may know the core of a steel clad door by the smell of wood, and its finishing material by temperature. Thinking about perception of architecture however, even today (Downton, 2009) comes often little further than the five basic senses. Visual perception is widely considered dominant over other senses, and consequently visual aspects are dominant in architecture (Gibson, 1986; Lym, 1980; Mace, 1977; Rapoport & Kantor, 1967). Regarding the undervaluation of the other senses, Edward T. Hall argued that user and building get literally out of touch: "In spite of all that is known about the skin as an information-gathering device, designers and engineers have failed to grasp the deep significance of touch, particularly active touch. They have not understood how important it is to keep the person related to the world in which he lives" (Hall, 1990).

In symbiosis, the full range of senses is essential in perception of building. For this, man uses the senses as a perceptual system, as described by Gibson (1983). The

significance of Gibson's work lays in the notion that in perception as an overall system, all senses are involved in combination with man's actions. In order to understand man's perception *through interaction with* building however, it is important to focus on the interplay of impulses distinguished by Gibson.
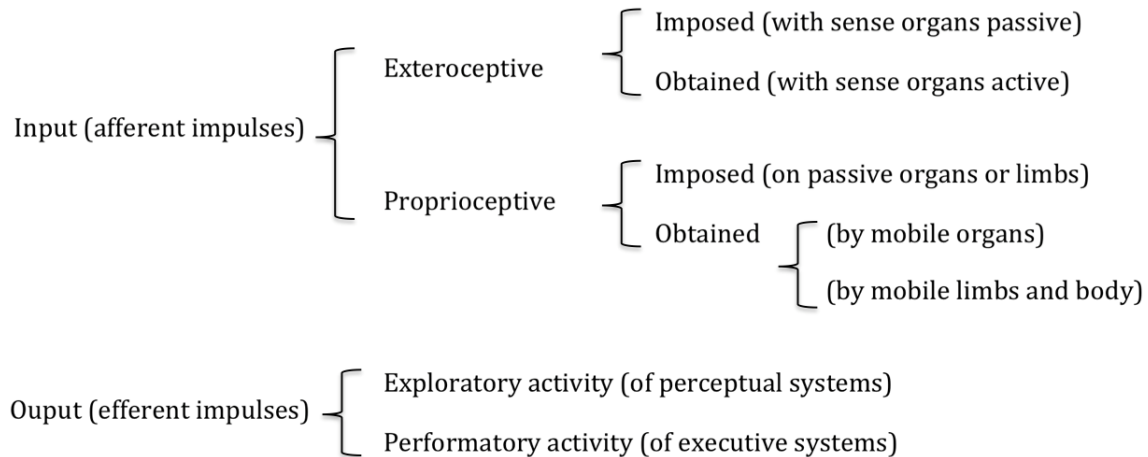
Diagram 1: Classification of impulses by Gibson (1983).

The main bifurcation in Diagram 1 is that of input and output, respectively the impulses we gather and those we send to our muscles. Exteroception is the perception of the world outside our body, whereas proprioception is about the body itself, e.g. the position of a limb. An exploratory activity of perceptual systems is for example moving an arm in order to touch a wall.

The distinctions made in Diagram 1 are primarily an intellectual concept. Perceptual systems overlap each other whereas for example the concept of distinguishable motor and sensory nerves (resp. output and input in Diagram 1) is not found in anatomy. "The correspondence between nerves and senses is more false than true" (Gibson, 1983). In perception of the built environment, all senses are involved and all impulses contribute.

A sense that is less known by the common public is kinesthesia; an exteroception by performatory action. In Diagram 1 these two seem far apart, although Gibson's holistic approach already suggests their interdependence. In any interaction with an object, we perceive that object's properties through the interaction (performance) itself. For example when we move a chair, we get to know its weight, sturdiness, temperature, friction with the floor, the smoothness of the floor, etcetera, all is (passive) exteroception. Bloomer and Moore (1977) said about kinesthesia: "you may sense your body motion haptically by detecting the movements of joints and muscles through your entire bodyscape. [...] No other sense deals as directly with the three-dimensional world or similarly carries with it the possibility of altering the environment in the process of perceiving it." Usually this perception is not a conscious one; however, it is an important source of information for our relation with the environment. In THE

T<small>ACIT</small> D<small>IMENSION</small>, Michael Polanyi (1983) distinguishes *proximal* from *distal* phenomena and explains how they are linked. It is possible for example, to use a stick to check if the path we are walking is safe, without using our eyes. Through the stick, we investigate the texture of the path, i.e. a phenomenon on a distance (hence *distal*). The actual connection to our senses however, lies in the hand where the stick generates stimuli in the skin. The sensation in the hand is *proximal*. Polyani argues that our tacit skills are marked by a focus on the distal part of this form of perception. In snowboarding for example, we acquire the tacit skill of knowing the snow whereas none of the senses actually touches it. The vibrations we feel in our feet, the changes we feel in our sense of equilibrium and the sounds we hear from the board scraping the snow, all combine in our sensation of riding the snow. This distal sensation is also a plausible explanation for a seemingly irrational behavior observed in (Whyte, 1988) of people preferring to displace a chair before sitting down on it. No matter the initial position of the chair, people will move it. The possibility and freedom to move the chair is presented as an explanation for people's preference for non-fixed over fixed chairs in public spaces. This reasoning however, lacks a clear incentive for the behavior. Performatory exteroception provides such an incentive, as the action of moving the chair rewards us with detailed cognition of the chair and its environment.

> The door pull or handle of the main door is the handshake of the building, and the pulling of the door with one's body weight is often the most intimate encounter with an architectural structure (Pallasmaa, 2009).

This handshake with the building is perceived in a similar fashion. We use, among others, our sense of kinesthetic, which is our sense for motion. While touching an object, we experience motion and vibrations that put us in contact with the context of the object. Much of the joy of riding a bicycle is the sense of being in contact with the vehicle as well as with the road. One of the attractions of sailing is the interplay of visual, kinesthetic, and tactile experiences (Hall, 1990).

Parallel to the notion of proximal and distal phenomena mentioned earlier, Peter Westbroek compares the use of artificial devices with an actual extension of the body. Such artificial devices afford activities the natural human body cannot perform. Thus, man disposes of additional organs which, moreover, are exchangeable (Westbroek, 2012). This interpretation of the use of tools as an extension is a physical form of Heidegger's idea that in dwelling, the distinction between man and the world dissolves.

Yet another form of understanding buildings is the projection of our own experiences on the building. Through empathy, we know what a building is 'doing'. This relation was explained by Wölfflin, as "we can appreciate the noble serenity of column" only because we understand gravity, that is, because we have all "collapsed to the ground when we no longer had the strength to resist the downward pull of our bodies" (Wölfflin 1994 cited in (Mallgrave, 2010)).

A discipline close to the topic of this thesis is Ecological Psychology, in which perception is considered an activity performed by the whole of body, mind, and environment, as argued by Gibson (1962, 1983, 1986). Tim Ingold explains "The point of departure for ecological psychology is the proposition that perceptual activity consists not in the operation of the mind upon the bodily data of sense, but in the intentional movement of the whole being (indissolubly body and mind) in its environment" (Ingold, 2000). What is important according to Gibson (1986), is that with the *practical* knowledge we obtain through the senses (direct perception), we also obtain information resulting from how we act. As a result, we can project our next action based on what options the environment affords. "To perceive an object or event is to perceive what it *affords*" (Ingold, 2000).

A next level in perception is how we appreciate properties and affordances, and how we value them. Through the daily interaction with objects and perception of their affordances, these objects get a certain meaning for us. Ingold argues that meaning is not something consciously attached by the human mind to a given object, but an attribute resulting from practical engagement with the lived-in environment. This attribution of meaning thus has a counterpart in derivation of meaning. As explained in THE MEANING OF THINGS, DOMESTIC SYMBOLS AND THE SELF, (Csikszentmihalyi & Rochberg-Halton, 1981), to young people objects that afford action are more meaningful, whereas the elderly tend to cherish objects that afford contemplation, e.g. books that change the view on life or photos that bring back memories.

Eventually, Ingold points out that Heidegger's suggestion that the self and the environment merge in *dwelling* (Heidegger, 1997) coincides with Merleau-Ponty's overall contention in PHENOMENOLOGY OF PERCEPTION, that a similar merge occurs of the perceiving agent (as a being-in-the-world) and an embodied presence. "The body is the vehicle of being in the world, and having a body is, for a living creature, to be involved in a definite environment, to identify oneself with certain projects and be continually committed to them" (Merleau-Ponty, 2002) cited in (Ingold, 2000). The body thus becomes an instrument for perception (and its investigation of affordances) the same way a blind man's stick affords proximal sensation of a distal phenomenon. Moreover, because *'we are our body'* (Merleau-Ponty) and we possess unique personal knowledge of it, we consequently are the permanent subjects of our own perception. Since our perception of the world always goes through our body, and is inevitably filtered and colored by our knowledge of that body, our self consequently influences it. This thesis therefore maintains that the symbiosis as such is a reflection of the self.

Operation

Operation is about human action in building. A distinction is made here between operational and instrumental since they are overlapping, yet distinct, activities. A building is an instrument for shelter, living, storage, communal gathering etcetera, whereas *operation* is the adjustment of the building in order to facilitate specific use.

For example, blinds are operated in order to use a room for sleeping. Operation includes building elements like operable windows, doors, screens, blinds, and services. Introduction and positioning of furniture is operational too, whereas their use is instrumental.

It follows from the above discussion on perception that operation of building elements plays a vital role in being-in-the-world. Michel de Certeau suggests that space exists by the mercy of its use, i.e. the notion of *doing space* versus *making space.* With the concept of *walking the city,* De Certeau (1988) describes how in practice users create the city by walking it, unlike the concept of the city created by designers. In practice, the creating and generating forces in the course of use change the planned environment. In addition, the no-man's-land between the walked city and the constructed city provides necessary psychological breathing space.

In order to operate a building element, people need the skills related to that operation. We acquire most of these skills during upbringing and education. Opening a door may look straightforward; still the need to push or pull is often ambiguous. Some people cannot handle toilet doors in airplanes, as the design is too different from what they know as a door: such doors have *hinges in the middle* and have to be *pushed inwards* in order to make the door *fold to the side*. More skills have to be learned when one is confronted with new technology. The newly built underground metro in Delhi India suffered from considerable congestion due to the many people who were not familiar with turnstiles and escalators.

This operational literacy is subject to the practice people get and of course their operational dexterity. The degree of comfort people experience in a given context is related to their operational dexterity in that context. The 'environmental docility hypothesis' explains the stress people experience from a lack of operational choices:

> "... the more competent the organism - in terms of health, intelligence, ego strength, social role performance, or cultural evolution - the less will be the proportion of variance in behavior attributable to physical objects or conditions around him ... With high degrees of competence he will, in common parlance, rise above his environment. However, reduction of competence, or deprived status, heightens his behavioral dependence on external conditions" (Nahemow & Lawton, 1976).

Operational literacy contributes to a person's sense of being in control.

As for the human body, its anthropometric characteristics like size, proportion of body parts, and mechanical degrees of freedom, determine the fit with material components of the environment. These characteristics differ with the individual and change over his lifetime, but cannot be changed by him. Behavior and adaptation deal with other physical aspects of the environment like temperature, humidity, and light. In addition, the human body can be trained for adaptation and tolerance. When regularly exposed

to a certain stress factor, people develop more tolerance. People who fall into cold water experience potentially fatal thermal shock. As most swimmers and sauna visitors know, one can train his body to cope with such sudden thermal changes. Inversely, comfort can spoil the body. Parallel to what is known in medicine as the Hygiene Hypothesis[3], a Comfort Hypothesis could be proposed regarding the phenomenon that providing more comfort to the human body, will reduce its tolerance to uncomfortable conditions and thus induce stress, as shown in research on the relation between the use of air-conditioning and maladaptation to heat (Liao & Cech, 1977).

Interaction with building elements therefore increases operational literacy, sense of being in control, and tolerance of variations in comfort. The latter two appear to be interrelated as well. Studies (Brager, Paliaga, & de Dear, 2004; Wagner, Gossauer, Moosmann, Gropp, & Leonhart, 2007) on climate control in buildings show evidence that "subjects with greater access to control (in particular, the operable window) are more tolerant of, and in fact may prefer, conditions that may not be in the center of the comfort zone [whereas...] people who have limited or no control over their office thermal environment, as is the case in the vast majority of air-conditioned office buildings, tend to be less tolerant and accepting of suboptimal thermal environmental conditions" (Brager et al., 2004). This phenomenon is formulated in the *Adaptive Comfort Hypothesis* which proposes that "thermal preferences are based, not just on conventional heat balance factors, but a shifting of expectations resulting from higher degrees of control over their own environment" (Brager et al., 2004).

It is typical of modernism and functionalism to adopt the term 'user' to refer to the people who inhabit or occupy a space. 'User' was used in order to objectify human characteristics and translate them into programs of requirements, which in turn would fit with the modern production process. Ernst Neufert's BAUENTWURFSLEHRE (Neufert & Kister, 2009), is emblematic of this objectivation. One thesis of Aldo Rossi's (1982) THE ARCHITECTURE OF THE CITY, is a critique on this 'naive functionalism' where Rossi specifically "rejects that conception of functionalism dictated by an ingenuous empiricism which holds that functions bring form together and in themselves constitute urban artifacts and architecture".

A necessity in functionalism and the application of 'user' is *determinism*, the idea that based on cause and effect, the behavior of users and occurrence of events are predictable. This determinism afforded the description of any activity inside a building and thus the implementation of the modern lifestyle. In HOUSEHOLD ENGINEERING: SCIENTIFIC MANAGEMENT IN THE HOME (Frederick, 1920), elements of the traditional household are transformed into an efficiency-focused process, supported by modern technology. Jonathan Hill (2003) points out that functionalism itself was one of the most alarming aspects of the modernist agenda since those who adhered to it thought

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[3] The hygiene hypothesis states that overly hygienic conditions in childhood can result in underdevelopment of the immune system, and thus cause susceptibility to allergies.

they had science on their side, although no scientific validation was possible. Determinism is only the *assumption* that the user is predictable and obedient.

In order to break from the functionalist confinement, Hill (2003) identifies three types of users: the passive, the reactive, and the creative user. The passive user is predictable and unable change anything. The reactive user modifies the physical space but respects the boundaries of the architect's work. The creative user creates new spaces, meanings, and uses. The passive user is in a precarious situation since interaction responds to man's urge to act and rewards him with sense of achievement. Frustration of this urge can lead to what in psychology is known as 'learned helplessness', a phenomenon that occurs in patients and lab animals who are taken care of too much and, as a consequence, don't know how to take care of themselves and just give up (Seligman, 1972). The precariousness of the passive user's situation lies in its inherent temptation. What is perceived as comfort, is in fact absence of sensation (Bloomer & Moore, 1977). Lack of comfort is a functional problem. According to Alexander (2002d), 20th century architecture education was dominated by a "tyranny of functional problems" and thus loses its sense of life.

Embodiment

As discussed above, the human body as a whole plays a pertinent role in perception. The bodily experience is called embodiment. In this thesis, embodiment is considered as the aspect of symbiosis in which man and building become one body. According to Paul Dourish (2001), "Embodied phenomena are ones we encounter directly rather than abstractly" and "Embodied phenomena are those that by their very nature occur in real time and real space". The fact that the body is the medium by which we learn from experiences gives rise to the idea that it is the body itself that learns. In THE THINKING HAND, Juhani Pallasmaa (2009) explains how the skills of the craftsman and artist are embodied in the hand, rather than in the conscious mind. Our existential wisdom is of embodied nature. Pallasmaa's book is dedicated to the relation of embodied skills with existential wisdom and underlines the essentiality of bodily interaction in the creation of art and architecture. For Hassan Fathy, the connection with our inner self goes around all rationality. Techniques must be appropriate to user and context, and be controlled by what Fathy once described as 'the innate knowledge that comes directly from the emotions, without study or analysis, or what psychology calls the subconscious' (Steele, 1997).

This idea of embodiment closely relates to the concept of 'extension of the body'. In a cognitive sense, they both contribute to physical insidedness. "Physical insidedness is an implicit awareness, an experiential familiarity with the physical features of a place as a result of repeated use" (Boland Ahrentzen, 1992). The ability of people to acquire physical insidedness with a building depends on their 'physical literacy', i.e. their sensitivity to the physical characteristics and their ability to operate elements of the building.

Place Attachment

> "Your name already is ironic. How is it possible that your name is Haussmann? In German, it means something like 'master of the house' doesn't it? I have read that when you began with the works for the extension of the boulevard that today bears your name, you did not hesitate to have the house demolished in which indeed you were born. For me that says it all." (de Rosnay, 2011) [translation SdM].

Extensive familiarity with a place eventually leads to place attachment. According to Altman and Low (1992), "Attachment to place is a set of feelings about a geographic location that emotionally binds a person to that place as a function of its role as a setting for experience". This experience is not only about tangible interaction, but includes the intangible perception of others being active in that place (Brown & Perkins, 1992). In addition to *physical* insidedness, Boland Ahrentzen (1992) distinguishes *social* and *autobiographical* insidedness. *Social insidedness* is the outcome of integration into the social milieu of a place, whereas a*utobiographical insidedness* signifies a sense of personal history or bonding with a place as a result of having experienced personally meaningful events there. The meaning a certain place has to a person is results from these forms of insidedness. The home is the place of autobiographical insidedness *par excellence*. In THE MEANING OF THINGS, DOMESTIC SYMBOLS AND THE SELF, Csikszentmihalyi and Rochberg-Halton (1981) argue that this insidedness applies to many objects one uses. Things are in fact part of one's self, not in a mystical or metaphorical sense but in cold concrete actuality.

The bond with the home is subject to several factors, among which are age and gender. Csikszentmihalyi and Rochberg-Halton explain that in children and men, attachment to objects mainly goes through action, whereas women and elderly people cherish objects more in contemplation. Consequently, the symbiosis with the home changes with a person's age. Moreover, men find satisfaction in building a home, as an achievement after action, whereas women focus on maintaining a continuously happy household. As for the gender component, it follows from Csikszentmihalyi & Rochberg-Halton's observation that the roles men and women have in the household, are more distinct in traditional homes than in modern. The modern constellation is abstract and formal whereas the vernacular and today's informal are based on the household (Bangasser, 2000; Illich, 1983; Veblen, 1899).

Violation

For Dutch people, the most familiar sensation of extension of the body is undoubtedly that of riding a bicycle. As argued above, embodiment occurs with objects that afford intensive interaction with the body, and the bicycle therefore is even closer than an extension. One interviewee whose bicycle was stolen reported a sense of amputation.

Similarly, violation of the home, e.g. through burglary or vandalism, is experienced as a violation or even intrusion of the own body. A study on the effects of burglary revealed that being burglarized is experienced as being defiled, or even raped; that being burglarized is a violation of one's universe and causes a specific psychological and affective impact on the person's relationships with others (Korosec-Serfaty, 1985).

Although research has been done on the effects of crises on place attachment, there is need for new research on the inverse, i.e. the role of personal places and personal things in dealing with crises (Fidzani & Levenson, 2011).

Self

An important concept in the symbiosis of man and building is that of the s*elf.* Both the building and the occupants have a character, a personality, a self. A home is a *reflection* of the occupant's self, revealing aspects of his personality. A building can thus become an *extension* of self, especially when people feel attached to a place. When an occupant has ambitious intentions with shaping his home, it becomes a *projection* of the self; it tells us what someone wants to be or become. The façade can thus become a person's desired face, or indeed a mask. Since to create and maintain our own identity is a fundamental need in our psychological make-up (Lawson, 2001), personalization of the home is part of the development of self. The meaning of the home of course goes beyond that of the facade, or as Clare Cooper Marcus (1992) said: "The family home [...] is, for most people, such a powerful communicator of identity that its loss [...] may be as large a threat to self-identity as the loss of a human relationship."

In THE THINKING HAND, Juhani Pallasmaa (2009) refines this idea: "Fundamentally, in a work of art we encounter ourselves, our own emotions, and our own being-in-the-world in an intensified manner. A genuine artistic and architectural experience is primarily a strengthened awareness of self."

As mentioned, meaning of household items comes to their affordance of contemplation and autobiographical insidedness. Meaning and significance are therefore present in objects in the home that represent the past. Such items afford the perception of *passage of time*, which is essential to our sense of being-in-the-world.

Symbiosis as a concept can also reveal the *exclusion* of the self, e.g. in prisons, in mass housing where anonymity is the norm, or in buildings for institutions with high authority such as courts and governments. The sense of inclusion versus exclusion is linked to identity versus anonymity. The notion of deliberate exclusion will be discussed under Society and Symbiosis, page 61.

The self of the architect was introduced in architecture in the transition from what Alexander (1964) calls *un-self-conscious* to *self-conscious* architecture. Un-self-conscious is architecture based on tradition and best practices and developed over many generations. It holds no role for the individual expression of the

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builder/designer. Self-conscious though is architecture in which individual expression of the builder/designer is clearly present.

In HOME AND HOMELESSNESS, Kimberly Dovey (1985) points out that in the process of design, the relationship of the architect with the building is one of creative identification. This relationship has parallels with the becoming-at-home with a place that dwellers undergo. The potential conflict is where these two identifications collide. Besides some designer's inability to let go of their darling, some dwellers regard the designer's personal relationship in combination with his professional superiority so high it keeps them from developing a normal relationship with the home. However, "A home cannot be someone else's work of art" (Dovey, 1985).

Personalization

Personalization is the deliberate decoration or modification of an environment by its occupants to reflect their identities (Sommer, 1974). It is part of territorial behavior in which personal items serve marking certain space and to regulate interactions with others. Based on various studies on personalization in office environments, Wells (2000) suggests a causal relationship exists between the act of personalizing and psychological well-being. Just like the home becoming an extension of the self through personalization (Cooper, 1974), personalization affords the creation of emotional attachment to the work environment (Goodrich, 1986 cited in (Wells, 2000)).

Personalization is a key ingredient of participation. By participating in an activity, the results of that activity become part of one's personal achievement. Robert Sommer (1969) illustrates this with the Peace Corps experience: it is easier for corpsmen to erect a school themselves rather than to make local people do it, but if they do indeed, chances are that the situation will return to the *status quo* soon after they leave. Sommer also points out that environmental consulting bears the occupational hazard of giving the client the impression that changes in design can solve everything, whereas an interest in environmental change by the client himself is more important. One of the case studies of this thesis showed that workers who were encouraged to personalize their workspace also took more care of the office as a whole.

A practice already signaled by Sommer in (1974) but continuing today is that of some architects specifying in their contracts that no alteration be made to the building without their written permission. In line with that reasoning, some facility managers pose restrictions on workspace personalization, all based on the assumption that an orderly environment contributes to efficiency, for which there is no empirical evidence according to (Sundstrom, 1989 cited in (Wells, 2000)). This tendency to prohibit personalization is an aspect of commodification. In the framework of the vernacular-commodity dialectic, personalization is inherent to vernacular. Its counterpart is alienation. Prohibition of personalization thus is the frontline of the exclusion of the end-user.

Certain acts of personalization are symptoms of a failing environment. When executives put calendars on glass doors or students bring worn out couches into the faculty's new high style building, probably something is not as people would like to have it. Too often, the response to such signals is to forbid certain actions and behavior, typically by putting up signs.

In **A PSYCHOLOGY OF BUILDING**, Glenn Robert Lym (1980) distinguishes two aspects in the spatial order of homes - an internal order and an external order. The internal order has to do with our sense of self and involves the many sides of our character, our various 'faces'. The external order also involves how we see ourselves but with respect to the outside world. A suitable home helps people to realize both these spatial orders and to get insights about themselves and their lives. Besides this reflection of Self in the home order, Lym also discusses cases where establishing a proper external home order failed. Typically, the residents saw what seemed like the creation of a new 'urban community' to the architects as 'a project'. Since the project was not a reflection of the residents' self, they experienced exclusion from society. Vandalism soon became the ritual of destroying an external home order that people could not relate to (Lym, 1980). Jane Jacobs (1961) already pointed out that vandalism is often mistaken for problematic behavior whereas it is foremost symptomatic of a dysfunctional environment. Vandalism is a destructive variety of personalization.

The potential mismatch between the end user's internal and external order explains also, why the architect should not be seen as the extension of the end-user. End-users among themselves often do not share the same ideas about the external order, let alone the architect would be able to identify a definitive overlapping set of user spatial orders by which to design (Lym, 1980).

Personalization as a term is also used in engineering to designate the options a person has to adjust a certain product. On a computer for example, one can choose the layout of the screen and set all kinds of preferences. In an office, one can set the height of the chair and perhaps the desk. This type of personalization however is of a non-vernacular kind. The user can only choose from the options available. The user does not add something personal. The 'personalization' is merely a reflection of preferences, not of the self.

Existential

Much of the above already covered the idea that in our interaction with buildings we connect our self with the world and the universe. Bloomer and Moore (1977) phrased it succinctly as: "One of the most hazardous consequences of suppressing bodily experiences and themes in adult life may be a diminished ability to remember who and what we are."

Summary

Today's thinking in environmental psychology is marked by the notion that our body, our actions, our mind, and the world around us are all inextricably linked whereas the Cartesian paradigm held that the world is divided into three areas of existence: that inhabited by the *physical body* (matter), that inhabited by the *mind*, and that inhabited by *God.*

For humans, in order to survive, it is important to have physical interaction with the world. Not only does perception of the world involve all our senses and our actions, much of our learning is dependant of embodiment too. Eventually, the proper development of our sense of self requires interaction with objects, places, and time. In order to *be*-in-the-world, we must *do*-in-the-world.

The personal dimension of symbiosis requires activity, interaction, exploration. It is about body *and* mind. For a full symbiosis, perception, embodiment, personalization, place attachment, extension of the body, and existential aspects must all play a significant role. Frustration or deprivation of any of these aspects is detrimental to it.

Building and Symbiosis

In addition to the human factors mentioned in the previous chapter, buildings too have properties that afford the symbiosis. This chapter describes first the mechanism of symbiosis, second the factors related to builders and third the factors related to everyday users.

Affordance of Symbiosis by Operation

Pivotal in the mechanisms of symbiosis is the notion of affordance, as mentioned earlier in relation to the human factor of perception. Important in environmental cognition is not only the perception of the physical characteristics of a given object, but also what that object *affords* (Gibson, 1977). Paul Dourish explains Gibson's affordance with the example of the office chair that on one hand affords sitting to him, since it matches the length of his legs, but does not afford sitting to a horse since it is not 'appropriately equipped' for that affordance. Thus, "an affordance is a three-way relationship between the environment, the organism, and an activity" (Dourish, 2001). Consequently, affordance is only possible when the building allows/facilitates a given activity. It follows from the above that affordance makes a building contribute to symbiosis. A building that affords affordance, affords symbiosis.

As explained under Operation (page 44), bodily interaction is essential in perception. A building that requires operational interaction with the body therefore affords more perception and a more intense symbiosis. Operable building elements like windows, doors, blinds, and curtains contribute to interaction. Mechanization, motorization, and automation of such elements reduce interaction and affordance. An example is the application of revolving doors in building entrances. Such doors are nowadays

motorized and automated, which makes all physical interaction of users with such doors obsolete. Pushing the door is not needed and even not allowed. Since the speed of the door is set to that of the slowest user, the doors revolve too slowly for most people. As a result, people tend to push it. When people touch the door however, it will stop immediately since it is programmed to avoid accidents. Contrary to the engineer's belief that a motorized revolving door is more comfortable, a hand-driven door fits better with normal variations in human behavior and puts the user back in control.

Photo 1. People have a handshake with the building by actively opening a door at the entrance of New York Grand Central Station. June 22, 2011.

Since people do not touch these elements, perception is reduced to mostly visual. Touching and handling a door is no longer part of the experience of entering the building. Literally, user and building get out of touch. In this thesis, this phenomenon is called the *Untouchable Building Syndrome*.

Similar effects occur in the application of automated lighting and energy efficiency strategies, where operation contributes to performance. Studies on the presence of operable windows and its relation with occupant comfort e.g. (Brager et al., 2004), conclude that "It is critical that buildings be designed so that occupants can be active participants in the indoor climate feedback loop, not simply passive recipients of whatever thermal conditions the building management system delivers."

As explained under Operation (page 44), active interaction contributes to tolerance in users, which helps them handle variations in levels of comfort. The ability to adapt then requires regular exposure to a stress factor (Liao & Cech, 1977). In the perspective

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of symbiosis, a building with sufficient operable elements affords more interaction. In line with this, the degree to which a building needs physical kinetic action from its occupants in order to function properly is an indicator for the degree of embodiment that will occur. Buildings that afford more interaction will yield more embodied knowledge in its occupants.

Photo 2. This twenty-first century revolving door autonomously processes a man out of the building. Touching the door will interrupt the process and leave the man stuck in the machine. Note the 'normal' door on the right, for 'disabled people only' as the sign says. September 9, 2011.

Operation of building elements has become more complex with the introduction of all kind of contraptions that afford operation over a certain distance. This mechanization in buildings has a long history. It really took off with the invention of the steam engine. Motorization replaced muscular power. Especially motorization has afforded the creation of autonomous building parts like the revolving door mentioned above.

The desire to understand the effects of mechanization upon the human being stood at the origin of MECHANIZATION TAKES COMMAND by Siegfried Giedion (1948), a study on to which extent mechanization corresponds with or contradicts human nature. The result of the study is an overview of how new mechanical objects extended the realm of artifacts and how their presence changed in everyday life routines. Mechanization rapidly changed the affordance of buildings and drastically changed the relationship of people with their buildings. Although the study shows mainly the instrumental side of mechanization, Giedion was driven by existential concerns. Giedion already saw that "Because mechanization sprang entirely from the mind of man, it is all the more dangerous to him." He foresaw that man would become ever more dependent of mechanization and that society as a whole would, instead of becoming more comprehensible and manageable, become much more complex. "Means have outgrown

man." This is certainly visible in the history of product design. In the decade from 1954 to 1964, the age of Populuxe (Hine, 1986) also known as the push-button age, the trend was to reduce the number of controls on household appliances and preferably create something that worked with only 'one push on the button'. Drudgery would become something of the past. It limited however also the control the user could exercise over that appliance and soon users started asking for more buttons. Hine argues that the lack of options offered, and hence sufficient control, culminated in the mythic image of the president of the United States having a button on his desk by which he could fire instantly the entire nuclear arsenal. The fear that someone would push it accidentally was emblematic of the discomfort people felt with the upcoming total automation.

Affordance of Symbiosis by Adaptation

Changing the building can extend the range of affordances of that building. A building that can be adapted affords more than mono function use. Adaptation is an integral part of vernacular architecture, as will be explained in chapter Reflection of the Builder (page 56). Already the material aspect makes clear that vernacular architecture affords adaptation better than modern architecture. Typical ingredients of the latter are concrete, glass, and steel. These materials are tough and durable, and require advanced professional equipment for application and adaptation.

Functionalism designates rooms and buildings to certain functions. In vernacular architecture, building layouts are of design that is more generic and thus afford adaptation to changed use. Despite modern architecture being less adaptable, the need for change in buildings remained. Therefore, the concept of *flexibility* was introduced. The first debates were about two forms of flexibility. One left the building unfinished to a certain degree so occupants could adapt and refine it. The second tried to create a building that afforded all imaginable future use. Herman Hertzberger was especially opposed to the latter approach since he expected it to produce boring results. The specter was "a glove that fits all hands and therefore becomes no hand" (Aldo van Eyck, 1962 cited in (Forty, 2000)). Forty (2000) mentions three strategies of flexibility:

1. *Redundancy* is a pre-modern strategy identified by Rem Koolhaas in space-wasting buildings like the panopticon prison and monumental palaces. "Flexibility is the creation of spatial margin – excess capacity that enables different and even opposite interpretations and uses." (Koolhaas & Mau, 1995).
2. *Flexibility by Technical Means,* a highly modernist approach in which technical systems of movable partitions, floors and other items afford changes in room arrangements.
3. *As a Political Strategy.* Critique of capitalism regarding its effect on the built environment centered on its tendency to commodify all aspects of domestic life. They were split into functional components and changed into tradable commodities. Henri Lefebvre's notion that *use* with all its diversity and

>unpredictability was a way to reclaim space from functionalist domination, made flexibility a political instrument. The ultimate aim of flexibility was to disturb the established property relations and functional classifications set up by capitalism.

In the transition from vernacular to modern, adaptation of the building pivots around the same issue as that of designers involved with home making. In line with the observation that "A home cannot be someone else's work of art" (Dovey, 1985), the purpose of flexibility was to deal with the problematic situation that the influence of the designer on the affordance of the building ended on the moment the occupants started using it (Forty, 2000).

Reflection of the Builder

>"Architecture is successful when it allows the contribution of craftsmen to happen. This is missing in modern architecture, whereas the Taj Mahal was built by thousands of craftsmen." Kamu Iyer[4].

Similar to buildings that require interaction with its occupants, buildings that require more interaction and skill from its builders show a reflection of that interaction. More interaction affords more satisfaction to those builders. This necessity of challenge is known from the notion of *alienation* in Marxist theory. According to Marx, in production reduced to labor, a worker alienates from the work, working, and eventually from himself. In THE THINKING HAND, Juhani Pallasmaa (2009) described the effect of challenge on embodied and existential wisdom: "Having realized that every serious professional has his ambition and pride, I [think][...] skilled craftsmen and builders like to face challenges, and consequently the work needs to meet the full potential of the maker in order to provide the desired inspiration and satisfaction." Not only is it healthy to be challenged, it is a necessary condition for happiness too. The effects of standardization in production and the use of standards in order to achieve comfort are therefore potentially counterproductive, or as Hassan Fathy (1973) put it: "A workman who controls a machine in a factory puts nothing of himself into the things the machine makes. Machine-made products are identical, impersonal, and unrewarding, as much to the user as to the machine minder."

A building's physical fit with the human body concerns elements like steps, stairs, door handles, and the like, i.e. those elements deriving their characteristics from anthropometric parameters. Industrial production however requires standardization and products will inevitably not fit perfectly with the context in which they are applied. Eventually they will not fit with the human body. In engineering, the design of these elements is the work of architects and industrial designers. On the construction site, the builder then has to fit the standardized products into the one-of design. The job of

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[4] In interview with SdM on December 20, 2012.

the architect is to make a design that affords application of the chosen materials. This means that the design must hold solutions for fitting standard materials. These solutions however are also part of the skills of the builder. Due to the division of labor, visible in the segregation of the building practice into architecture offices and contractor firms, this essential exchange of knowledge is what lacks in practice. The examples in Photo 3 to Photo 6 about the application of tiles, illustrate how this communication affords the reflection of the builder in the result.
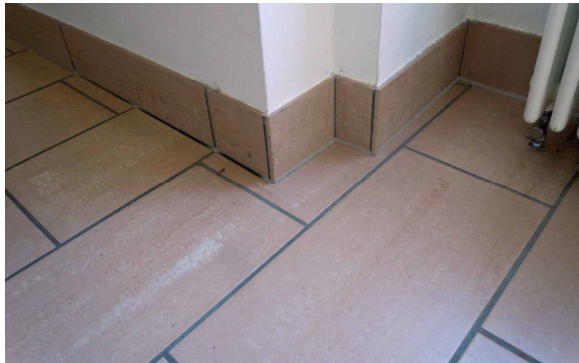
Photo 3. In a total division of labor, tiles are cut to fit wherever they meet the wall. No consideration has been given to how the patterns meet. The result is a product, not a reflection of the builder. Rolle CH, March 8, 2012.

Photo 4. Reflection of the builder. As an artisan, the builder has the skill to create a margin and give the tile pattern cohesion. Rolle CH, March 8, 2012.
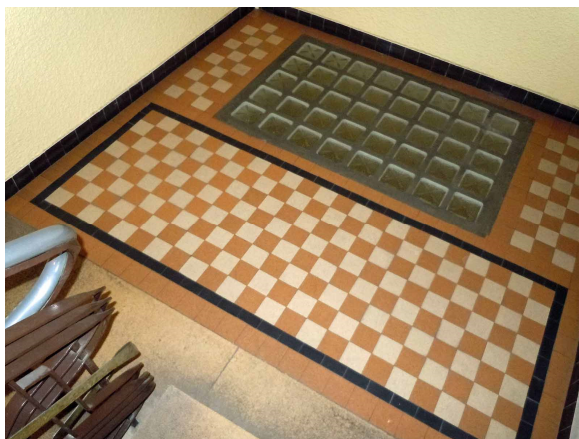
Photo 5. The architect adopts the builder's knowledge and designs a pattern in which margins and cut tiles dissolve. Lausanne, September 27, 2012.
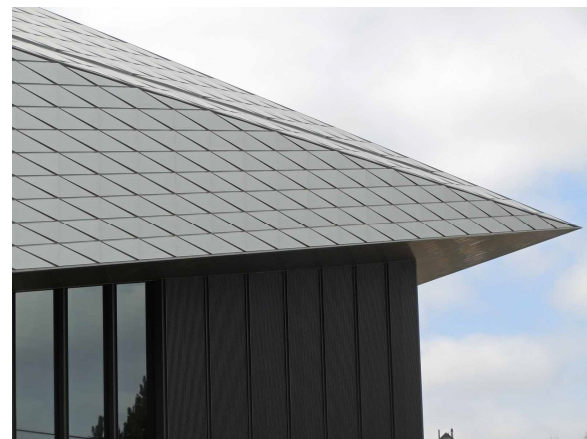
Photo 6. Super modern architecture is marked by customized serial production. The tiles of this roof are designed to ft exactly the overall shape of the roof, facilitated by the combination of CAD and CAM[5]. The skills of the builder making things fit are no longer required. EPFL, February 17, 2014.

In this example, Photo 3 shows no reflection of the builder's own input. In Photo 4 and Photo 5 the resulting patterns are 'whole' and reflect the builder's efforts to create

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[5] Computer Aided Design and Computer Aided Manufacturing.

something that is not simply cut off where it meets another element. Christopher Alexander (2002c) considers this presence of 'making things fit' one of the properties that put life into objects, and identifies it as *roughness*. Hassan Fathy (1973) too points at the importance of this reflection of the builder's hand. Photo 6 shows a high-tech project in which the designer and the builder have avoided roughness through application of total design and subsequent assembly of the product. Roughness and margin are not present. It lacks the reflection of the builder, and thus the sense of life.

In NOTES ON THE SYNTHESIS OF FORM (Alexander, 1964), the effects of mechanization, motorization, and industrialization on the synthesis of form are identified under the name of self-conscious culture, as opposed to unselfconscious culture. The unselfconscious culture is that of tradition. It is clear that in traditional cultures, forms come from long experience and have certain fixity. Form-builders will only turn to changing a form when the existing form leads to persistent problems. In addition, the builder is often also the owner and the materials used are typically of local origin. Consequently, the builder has an immediate relation with the form; he actually lives in it. The man who created the form perceives its needs by living in it. An important marker of this ensemble is its immediacy. The form as it is and changes, is a direct reflection of the dwellers interaction with it. Failure and correction go side by side. This whole system is actively self-adjusting and produces well-fitting forms. Because of the immediacy, the building is in equilibrium with the needs. From this description of the unselfconscious culture, it is easy to think of the markers of the self-conscious culture. Since the owner is not the builder and materials have to come from far away, the typical immediacy is no longer present. The reaction to failure becomes indirect and takes more and more detours. In modern economy, the chain of people involved in making a hole in a wall can consist of tenant, rent agent, owner, maintenance agent, contractor, subcontractor, and mason. Since it is hard to push the urge to act through this chain, failures must be considerably severe before they lead to adjustments. By the time the adjustments are ready, new irritations will have surfaced and as a result, the building will hardly ever be in equilibrium with the needs. As making the initial form of the building is no longer a job for the owner, the assertion of the architect's individuality (i.e. his self) is typical of architecture as a self-conscious discipline.

Reflection of Occupants

In THE PRODUCTION OF SPACE, Henri Lefebvre (1997) distinguishes *lived* space from *abstract* space, rather the same way Alexander does in his works. According to Lefebvre, abstract space is the space assigned to architects and developers. "This space has nothing innocent about it: it answers to particular tactics and strategies; it is, quite simply, the space of the dominant mode of production, and hence the space of capitalism [...]." Abstract space therefore is a *commodity* as distinguished from vernacular by Illich (1983). Lefebvre's *lived* space is the space of everyday life of the user. It is a concrete space and therefore subjective. It is typical of lived space to bear

traces of wear, in Lefebvre's words: "Lived space bears the stamp of the conflict between an inevitable, if long and difficult, maturation process and a failure to mature that leaves particular original resources and reserves untouched." This 'stamp' affords the perception of *passage of time*, as discussed above.

Lived space therefore bears the reflection of its occupants, of people. Dead space does not. Pristine new space with its absence of traces and reflections is sterile, i.e. devoid of life. The extent to which these reflections are present depends on how much the building affords personalization.

Personalization is not only a way to appropriate a place; it also plays a role in de-alienation. Buildings produced as a commodity afford little personalization and keep their alien character. Putting personal items and colors around the house is a way to remove the alien character. Especially mass housing is highly alienating and affords little personalization. Photo 8 shows a failed multi-storied housing project, where squatters have appropriated and de-alienated a tenement by personalizing it. The developer of the building went bankrupt and by virtual absence of an overall owner, the *persona* (face/mask) of the occupant reflects on the building. In this case, only the failure of the project affords personalization.

Photo 7. Façade (face) as a reflection of the occupant. Mapusa India, March 10, 2010.

Photo 8. Personalization as de-alienation: squatters making home in the abandoned Kolya Khata housing. Dharavi, April 19, 2013.
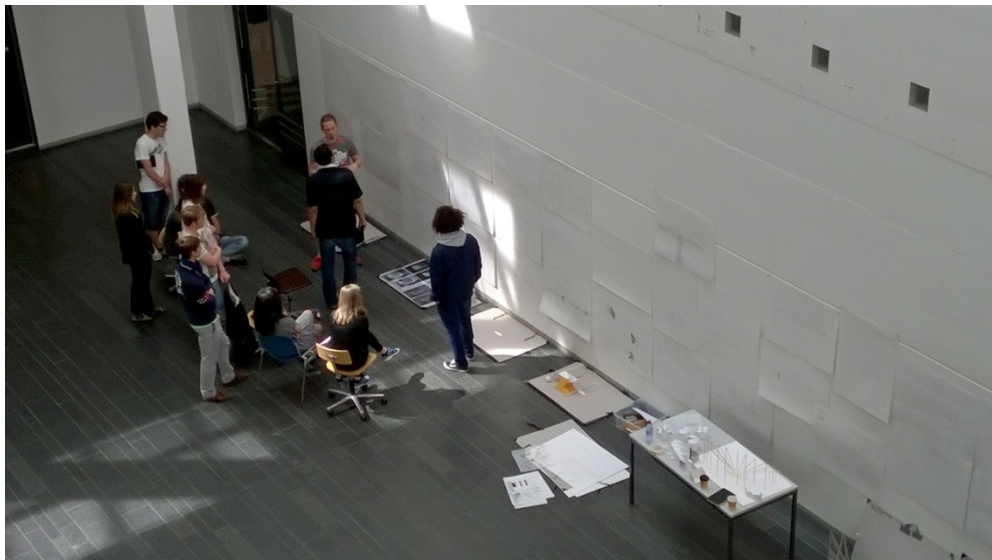
Photo 9. Normal, daily use of EPFL's architecture building. The caretaker prohibits this behavior. May 12, 2015.

In institutional buildings, occupants often enjoy little possibility for personalization. The idea that it might leave traces on the building inspires many a caretaker to prohibit all decoration reflecting the presence of people. An example is the e-mail in Appendix 1: Call for a Clean Wall, calling users of EPFL-buildings to refrain from activities like using adhesive tape on walls. Putting up drawings however, is normal behavior in an architecture institute. The building itself, as a physical structure, would

afford reflection of its occupants. It is however the formal structure, i.e. the rules set by the caretaker that inhibit the affordance.

In LIFE BETWEEN BUILDINGS, Jan Gehl (2000) investigates how buildings support life in the street. His thesis holds that functionalism was a planning ideology focused on the physical and material, neglecting the social and psychological. Gehl observes that life thrives best in places that support social activities, i.e. where the private and the public meet. Houses with front yards for example, afford social activities in semi-private space. Thus, the yard is an extension of the home, open to other people. Personalization of the exterior of the house, like in Photo 8, is equally an extension reaching out to other people. Gehl stresses the importance of a soft building edge, i.e. a gradual transition from public, semi-public, semi-private, to private. Social activities prefer the semi-public and semi-private, like Jane Jacobs' sidewalks and Alexander's pattern of 'Building Edge'. Life between buildings can only exist when there is sufficient space for reflection and presence of occupants. In other words, where symbiosis is tangible, life is present.

Society and Symbiosis

The social dimension of symbiosis is about the role it plays in social relations and activities, and how the building reflects social life. Apart from providing shelter to the social life in households, communities, organizations and companies, a building and its elements are the playing field of everyday social dialectic. The operation and use of certain building elements, e.g. opening a window, requires negotiation with other people and thus affords occasions for (re-) establishing, reconfirmation, or resolution of hierarchical and territorial issues. With several people in a room, all that is part of shared use will be subject to negotiation. Would you mind if we leave the door open, switch more lights on, and indeed open a window? Such negotiations not only serve the operation of the building elements, they also help to establish social structures like hierarchy and social order. A building that affords operation and control by the user therefore not only performs better in terms of physical comfort (Brager et al., 2004), it also requires social interaction and thus performs better in terms of social comfort. Besides the *physical insidedness* that comes from frequent interaction with an object (discussed earlier under Embodiment), there is *social insidedness*, the knowledge of the social patterns that comes with being an 'insider' and the integration into the social milieu of a place (Rubinstein & Parmelee, 1992). Acquiring physical insidedness goes hand in hand with acquiring social insidedness. The trend in engineering to design buildings that function more and more autonomously in order to save energy is likely to lead to psychological and social discomfort, since such buildings afford less insidedness and thus less place attachment. Instead, disconnection of the building, the people, and the social may occur, effectively disassembling the symbiosis.

The possibility to personalize one's place also plays a role in this social dialectic. Normal human territorial behavior requires a certain marking of the space that one appropriates. Policies that hinder personalization, also affect the establishment of social structures.

In environmental psychology, a building's support of social life is expressed in the dialectic of sociopetal versus sociofugal (Hall, 1990; Sommer, 1969). The first brings people together, whereas the latter disperses them. Sociopetal and sociofugal are use-specific: sociopetal qualities are essential for a cafeteria, but not suitable for a library.

Autonomy versus Heteronomy

The previous paragraph hinges on the equilibrium between heteronomy [6] and autonomy.[7] The social provides heteronomy to the individual who in turn exercises his autonomy and thus creates heteronomy to others. The building is, as it were, the ball in the game of autonomies. When the building becomes too autonomous itself, it will hinder the players in their game. The autonomy – heteronomy dialectic is similar to that of feeling *in control* versus *under control.* We are in control where we can exercise our autonomy, whereas we are under control in a heteronomous situation and somebody else is in control over us. Social control is of heteronomous character.

Photo 10. The autonomy of its occupants overloaded the climate system in this office building, hence the heteronomous intervention. Rolle,CH April 18, 2012.

Technology affords exercising our autonomy e.g. by allowing us to change the temperature in our room, but can also hand us to heteronomy, e.g. when we have no

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[6] According to Immanuel Kant, heteronomy is "an action which is determined by some outside influence (i.e., some force other than the freedom given by *practical reason*, such as *inclination*) impelling the *subject* to act in a certain way. Such action is nonmoral (i.e., neither moral nor immoral). (Cf. *autonomy*.)" (Palmquist, 2000).

[7] "Autonomy: an action which is determined by the *subject's* own free choice […]. […], moral action is defined as being autonomous. (Cf. heteronomy.)" (Palmquist, 2000).

direct control, and a machine regulates temperature. This is when the *technium* becomes autonomous. Another form of heteronomy is that of formalities, where not a natural person limits our actions but rules and policies.

Buildings as Signs of Status

The meaning a building has to its occupants has been discussed in the chapter about the personal dimension. In the social dimension, sociologists interpret the meaning of a building in terms of status symbolism (Csikszentmihalyi & Rochberg-Halton, 1981). A building affords expression of a person's status. This expression is not necessarily a correct representation. Keeping up appearances is all too common and a façade can easily become a mask. There are thus limits to the projection of status, since it may cause loss of credibility. Bloomer and Moore (1977) point out that an entryway "must respect and reinforce the feelings of identity of both the inside and outside communities".

Especially in the commercial world, buildings help draw the attention of target groups. Posh brands apply high style architecture on exquisite locations and thus justify high prices, whereas low-end supermarkets deliberately choose for utilitarian styles. Since such supermarkets show no frills on which money was wasted, customers believe the shopping is of the lowest possible price. Status also includes the expression of power. Government buildings for example express their authority through monumental architecture.

Photo 11. Outstanding and exotic colors are typical of houses of the higher, often wealthier, castes. They are an expression of social economic status. In Vastu Shastra, certain bright colors ward off evil influences. Tara village, February 19, 2010.

Purposeful Symbiosis

In the above, symbiosis affords the expression of self *vis-à-vis* society. Symbiosis also works the other way; the building he is in symbiosis with can identify a person. The notion of people and building being linked has become an important standard in society. People are expected to have a workplace or at least have a fixed home. For long, rulers know that this link, especially with the home, provides an effective hold on people. Since buildings are immobile, they serve as anchor to the people who belong to it, and an easy way to find somebody is to wait at his home. The police use this principle in order to find runaway suspects, since even the toughest criminal will eventually go home. No matter someone's activities, everybody will eventually return home i.e. show up at a fixed place. Symbiosis not only links us to a building or a place, it actually ties us to it. We can identify and locate a person by the building he belongs to, i.e. by his symbiosis.

Similar to how symbiosis affords the identification and location of natural persons, it affords identification and location of more abstract entities like institutions and legal persons. A town hall is the home of a municipality whereas the municipality as such is an intangible construct. The same goes for companies. Office buildings and workshops afford clients and suppliers to get hold of the legal person they are dealing with. The role of the building is essential in this, since an address on itself gives no assurance. A so-called mailbox company looks less trustworthy, since it does not afford the assurance one gets through the symbiosis mechanism. An important part of the assurance lies in the fact that a building cannot be moved. In nations where people are all tied to a fixed location, people who do not follow that pattern are hardly accepted. The situation of the Roma people in Europe is emblematic of this phenomenon.

Imposed Symbiosis

Imprisonment is the ultimate form of tying someone to a place. This special variety of symbiosis affords society to exclude people who conduct undesirable behavior. It is of course a forced form of symbiosis and will most likely be experienced as an intrusion of the person's self. Similar to the phenomenon that possession produces an extension of the self; involuntary possession can ultimately become a violation of the sense of self (Belk, 1988). In TIGHT SPACES, Robert Sommer (1974) points out that inmates make a sharp distinction between what is imposed on them and what is personalized. This goes beyond their own interest as in prison disturbances, inmates do also not destroy the paintings made by their fellow prisoners.

House arrest is a softer form of imprisonment as it keeps one in his own house. It is however an imposed symbiosis and may have an impact on the sense of self as explained in the previous paragraph. A yet softer form is the application of curfews, by which social order tries to reestablish itself.

Homelessness

Homelessness is an exceptional case of symbiosis, as it is the case of people not in symbiosis with a building. Holding people accountable for what they do, is an important tool in maintaining social order. In practice, this requires knowledge of people's whereabouts, preferably their location, through which they can be found if needed. This is why most societies require their citizens to have a legal address. In society, symbiosis thus is a tool for keeping order. Consequently, rulers are not fond of people who are roaming around since such people are hard to control. Hence, there is a long history of criminalization of homelessness, especially under totalitarian regimes.

Wanderers, tramps, hobos, hikers, rovers, vagrants, and vagabonds are all terms with a negative connotation. These people are considered outlaws, a threat to order. They are supposedly thieves, and preferably avoided by decent people. Their not-belonging-to-a-building, i.e. their not-being-in-symbiosis, is problematic and unacceptable. Symbiosis is in fact obligatory. Even temporary shelter offered to homeless people is *de facto* an instrument of imposing order, since "A temporary solution – the shelter – represents the characteristics of discipline. Like a penal institution, a shelter can be the ultimate representation of the means [by] which the marginalized can be controlled, documented, observed, and molded." (Arnold 1998 cited in (Amster, 2008)).

Homelessness is thus an undesirable situation and, fed by the uneasy feelings described above, became subject of criminalization. Even today, vagrancy is still an offence in for example the United Kingdom. Crackdown policies often result in punishing people for activities that are essential to survival; like sleeping, procuring food, and going to the bathroom. Such activities are not illegal *per se*, but when performed without a home they become an excuse for police intervention. Besides criminalization, homelessness is anyway subject of demonization.

While the concept of property increasingly dominated the cultural and physical landscape, vagrants were more and more perceived as a potential threat to society's order. Later, when market economies became the leading model, vagrancy was even considered a threat to capitalism (Miller, 1991 cited in (Amster, 2008)). This is the more remarkable, as the inability of people to participate in capitalism was apparently seen as detrimental to that same capitalism, whereas research by De Soto (2000) suggests a more subtle relationship, in which a third element plays a key role in making capitalism work for people. De Soto explains how the possibility to hold people accountable and responsible for agreements they make, is essential to capitalism, i.e. capitalism does not work for those who are excluded from adequate formalization, legalization, and property systems. In short, this implies that capitalism is hindered by the exclusion of people, not by the excluded. Exclusion is indeed identified as a key factor in failing nations (Acemoglu & Robinson, 2012). In addition to the misconception about who is to blame, Randall Amster (2008) notes that "[at] present,

it is apparent that dominant culture heavily stigmatizes poverty as an 'individual pathology' more than a structural phenomenon ...".

Regarding the capitalist problem with homelessness, it is typical that when it comes to 'undesirables', security guards look if a person's appearance reflects that person's ability to consume. In commercial public space, people are profiled as presumed non-customers and for that reason sent away.

Note however that these negative sentiments are also felt regarding slum-dwellers. Although they do have a home, the supposed temporality of their dwellings is a minus on trustworthiness. A person with a permanent home, i.e. tied to a permanent building in a widely acknowledged formal property system, is more trustworthy. One would therefore expect societies to promote symbiosis and help people formalize their property, but quite the contrary appears to be the case. Instead of providing people access to formal property systems, many authorities have no policy for helping people into such systems (de Soto, 2000). "The homeless people live in a status that might be called 'no property'." (Baron, 2004 cited in (Amster, 2008)).

The criminalization of homelessness and the consequent forced application of symbiosis have a close link with the segregation into private and public. This segregation is typical of capitalism (see the discussion on *Flexibility* under Affordance of Symbiosis by Adaptation, page 55). In vernacular settings, free space such as the jungle exists, which affords non-public activities not performed in the private home. Examples are the use of the jungle as toilet, or as place for making love.

The non-home space in free space does no longer exist and therefore: "there is no place in the contemporary urban landscape for the homeless to be", since "to be without a home is to be without that domain of the private into which the public subject is supposed to be able to withdraw; to be homeless is thus to be thrust into the public without recourse" (Kawash, 1998) cited in (Amster, 2008). Symbiosis of people with a home has apparently become such a standard nowadays that living differently is no longer possible, hence Kawash's "no place". Note also the use of 'contemporary' in this citation. Formalization of property characterizes today's landscape, including the allocation of public space to public property. The result is a strict segregation into private space and public space and a ban on performing private activities (sleeping, going to the bathroom, and having sex) in that public space. It is in this formalization however that the real 'problem' of homelessness lies. People must comply with formalization and segregation, especially through a link with a private dwelling, as otherwise the system cannot cope with them. Hence the "there is no place in the contemporary urban landscape for the homeless to be."

As all space nowadays is allocated to private and public, homeless people have no place to go. They have no place to sit, sleep, or eat, and effectively not being permitted to perform these actions, they are not permitted to exist. Especially as public space is

increasingly commodified, personal self-expression is limited by the constraints of the consumer-identity. Symbiosis apparently has become obligatory in formalized societies.

One way or another, homelessness is believed to be a threat to order, as it does not keep people in a fixed home. As the lack of property over a home is hard to criminalize, other ways were sought to demonize homeless people. Miller (1991; cited in (Amster, 2008)) identifies two categories of demonization: *disease* and *disorder*. The first is a threat to physical order, the latter to social order. *Disease* hinges on the idea that homeless people do not have access to proper sanitary or a clean place to sleep and thus must be carrying diseases. Note that access to public facilities does not fundamentally change that image, as having a home, one's own place, is the real criterion. *Disorder* is implying anarchy and chaos, whereas it is hard to understand how these would directly come from homelessness. Randall Amster (2008) suggests that the disorder issue is related to paradoxical behavior of authorities that must keep the order. In the process of being arrested, homeless people lose the few items they possess, miss appointments with social workers, and lose contact with friends and families. In other words, they are stripped of the little symbiosis they enjoyed and become even more homeless. The police's behavior is therefore counterproductive. The observation that the homeless are a *challenge* for the police, is based on the fact that effectively they challenge the *competence* of the police (Mitchell, 1997 cited in (Amster, 2008)). The paradox of destroying people's symbiosis in order to make them go into symbiosis comes from incompetence.

Amster also points out that besides demonization as a strategy, authorities try to by-pass the impossibility to criminalize homelessness directly, by criminalizing behavior that is largely unique to the targeted group. Sleeping itself of course is a harmless activity but when sleeping in public spaces, in parks, on subway grates, or under flyovers is illegal; life without breaking the law becomes impossible for the homeless. Although such a law is applicable to everybody, it affects only the homeless.

An example of demonization being justified with reference to disorder and disease is the position of wanderers in Nazi Germany. They seemed initially rather safe, as being a wanderer fitted with the *Blut und Boden* ideology. Rural life was seen as ideal, peasants were heroes and urban culture weak. The Nazis' desire to control however, required restrictions on people roaming the country unchecked. In the 1930s, it was practically impossible to get all wanderers and homeless people off the street. The already straining housing shortage in the cities would only exacerbate when more than 100.000 people would have to settle. In order to get at least some control, the *Wanderbuch* was introduced, an identification document formalizing the status of the wanderer. Next, anybody without a *Wanderbuch* faced arrest for vagrancy. Three types of wanderers were then deemed to vanish from the streets: occupational beggars, physically or mentally ill, and alcoholics. In order to bring the people of these

categories within the reach of the laws on heritage and race protection, most of them were diagnosed psychopathic or mentally retarded for which they could be submitted to the forced sterilization program (Ayass, 1982).

Homeless and other so-called 'undesirables,' function to preserve public space as democratic, spontaneous, and inclusive. They are the proverbial canaries in the coalmine as their absence is an indication of public space being colonized by gentrification, civic morality, family values, neighborhood security (Amster, 2008). In a comparable fashion, William Whyte (1988) argues that 'undesirables' tend to go to public spaces that are abandoned by the general public, in other words spaces that do not function well as lively public space. Thus, 'undesirables' flag failing public spaces and too often people think that the necessary improvement will come with removing the flag. Note that Amster's and Whyte's arguments are complementary. Both observations provide indicators of the inclusive qualities of society and public space. The presence and absence of desirables and undesirables in public space are a measure for segregation.

Modern Homelessness

Homelessness is not restricted to the poor and those who have no shelter. In HOME AND HOMELESSNESS, Kimberly Dovey (1985) emphasizes the distinction between *house* and *home*. House is the built structure whereas "Home is then a highly complex system of ordered relations with place, an order that orients us in space, in time, and in society." She explains that the Modern movement and its industrial production of mass housing in high-rise blocks was based on a notion of the house as a machine-for-living-in, a piece of technology so rational and inadequate for home-making that the actual result was homelessness. *Homeless* is in some languages distinguished from *roofless* (*thuisloos* and *dakloos* in Dutch). Mass housing then is a measure against rooflessness, not against homelessness. By now, many of such housing schemes are demolished because of their extreme social inadequacy. They are an alarming example of what happens when the distinction between home and house is ignored (Dovey, 1985).

Yet another form of homelessness appears in today's metropolis. Executives who often go on business trip spend fewer nights at home than out. Even ordinary commuters fall victim to this trend. As commuting becomes too time consuming, more and more people sleep in hotels instead of their home bedroom. A short excursion on the vernacular – commodity dialectic is at place here. Since a hotel is in fact a commodified shelter, it is the inverse of home. The frequent hotel dweller therefore is homeless.

Squatting and Eviction

Squatting is the appropriation of a space that is not one's own and often means that dwelling is illegal. The illegal character of squatting disables the mechanism of identification by location, as explained under Purposeful Symbiosis. The occupant

engages in a symbiosis he ought not to be in, and other people (society, the police) will attempt to end the undesired symbiosis.

Eviction is the reverse of squatting. It terminates the symbiosis by separating the occupant from the building, i.e. separating the symbionts. Not only is eviction applied on squatters, it is also used to make space in the interest of the common good. Typically, the construction of big infrastructure comes with eviction. Besides the physical displacement, eviction also disrupts and destroys social structures and thus leads to the exclusion of people. Gentrification and redevelopment of cities are the vehicles through which this displacement and exclusion are accomplished, and eventually they are processes that remove people from the city's center. In gentrification, in order to extend certain people's symbiosis (improvement of the building) others are deprived of their symbiosis.

Domicide

As described above, separating the two symbionts disrupts and even terminates a symbiosis. Symbiosis also ends when one of the symbionts dies. Likewise, symbiosis of people and building ends when the occupant or the building dies. The demolition of a house essentially means the death of a home and, similar to the death of the occupant, ends symbiosis. Like the violent death of a person is called homicide, the deliberate killing of a home is called *domicide*. The term domicide is introduced by Porteous & Smith (2001) as "[The] deliberate destruction of the home. Briefly, domicide is the murder of the home. [...] More formally, domicide is defined as *the deliberate destruction of home by human agency in pursuit of specified goals, which causes suffering to the victims."* In symbiosis, domicide means to kill one of the symbionts and thus harm the other. Domicide is a form of symbiocide.

Porteous and Smith emphasize that domicide reaches further than the demolition of a house. It is also about forced relocation, alienation from context, and "This is the crux of the domicide issue; what is uprooted may be the very meaning of people's lives."

The destruction of home by natural disaster is not domicide, since it is not the result of human agency. Hence, Porteous and Smith speak of the "*murder* of home". The authors support this delimitation with the observation that significant difference exists between *mourning for a lost home* and the *domicide grief syndrome*. Mourning for a lost home already differs from the grief that comes with the loss of a loved one. Awareness of the temporality of life makes the death of a person part of the things that naturally happen. Buildings however, contribute to a sense of permanency and may exist over many human generations. Home also is more permanent as it is made of family and finds its continuity in the succession of generations. The possibility of loss of home therefore is less present in our intuition than the possibility of loss of a loved one.

Next, in the case of death of a person, by natural cause or by accident, acceptance is eventually possible because there is nobody to blame. With the loss of home and

certainly in the case of domicide, there is always somebody who caused it, or at least there is a 'they' to blame. Moreover, those who did it are often still present and, unlike murderers, cannot be prosecuted. This frustration makes it different from normal mourning. Another factor in the domicide grief syndrome is that acceptance by the victims would mean a *de facto* support of the domicide. "[... A]cceptance of their loss is yet another blow to their self-esteem, their sense of empowerment, their identity" (Porteous & Smith, 2001).

War is an obvious context of domicide. Both bombing and deportation destroy homes. The practice of retaliation by destroying the houses of suicide bombers' families is explicit domicide and a typical example of symbiocide. Since, as mentioned above, buildings afford the physical identification of abstract entities like organizations, it is obvious that attacks on such organizations often aim at the building. The September 11 attacks on the Twin Towers, Pentagon, and Capitol aimed at the homes of respectively the economic, military, and political power of the US. The loss of built structures was in a way secondary to the symbolic loss of the homes of these institutions, and the subsequent blow dealt to the US as a nation.

The deep impact domicide can have on a person is illustrated by the fact that grief is even felt for buildings in which people have had traumatic experiences, as was seen when Islamic State demolished Syria's most notorious jail, the Tadmur prison in Palmyra:

> Yassin Haj Saleh said he felt as if his home was destroyed. "I dreamt that I would visit it someday... This visit would redeem me... it would be a closure... The destruction of a prison that was the symbol of our slavery is the destruction of our freedom," he posted on Facebook. He considers the act of blowing it up "a huge service to Assad's regime of slavery". ("Inside Tadmur," n.d.)

More often though, domicide is committed in peaceful societies. The destruction of homes in order to make way for airports and flyovers is all too common. Although often disguised as 'the common good' or 'the public interest', the real aggressor in this type of domicide is the elite or the majority. Jane Jacobs (1961) points at the many forms that institutionalized domicide can take and the plethora of euphemisms that are used to disguise it; selective removal, spot renewal, renewal planning, planned conservation, to name a few. Porteous and Smith (2001) explain that even when all kind of legal procedures are followed correctly, it remains that it is not just a matter of property rights, but also the much-less-tangible rights related with home-making and the enjoyment of home. The position of the victim is the more awkward because the aggressor is often a legal entity, not a natural person. This makes defensive action the more difficult.

Photo 12. A so-called 'nail house' is one that the 'common good' fails to destroy. It refers to the image of an ingrown nail that is painful and almost impossible to be removed. Image Telegraph.co.uk.

Photo 13. Luo Baogen used the legal entity that secures his rights, to fight the legal entity that threatens his home. Image news.nationalpost.com.

Since domicide apparently can occur even within a legally justifiable situation, Porteous and Smith present five recommendations on decision-making in order to end and avoid domicide. Three of these recommendations aim at continuation of symbiosis by the controlled replacement of one symbiont:

- Before any decision to implement a project is made, all those likely to be affected by it in terms of domicide should be involved as partners in the decision-making process.
- Before any project is implemented, detailed plans for relocation and compensation should be drawn up in partnership with those to be relocated.
- After implementation, the welfare of the relocated should be assisted and monitored at least into the second generation.

Note the use of the word 'partner'; domicide victims typically do not have that position. The 'second generation' once more underlines that home reaches beyond the individual person, also in time.

Immaterial Domicide

Kevin Kelly (2010) points out that destroying a home not only occurs through demolition of houses. Clearing forests for example, makes that the tribal people evicted by it, have no habitat to come back to. Home stretches beyond the physical structure of the house.

Even drastic changes in the environment of a home can have severe negative effects on the sense of being-at-home, on the symbiosis. Environmental philosopher Glenn Albrecht identified a syndrome he calls 'solastalgia'- "the pain or sickness caused by the loss or lack of solace and the sense of desolation connected to the present state of one's home and territory. It is the 'lived experience' of negative environmental change. It is the homesickness you have when you are still at home" (Albrecht, 2005).

The self of mature persons is shaped around networks of relationships in both past and present. Since relationships are often embodied in objects (e.g. photos, trophies, and souvenirs), depriving older people of such objects can result in destruction of their self (Csikszentmihalyi & Rochberg-Halton, 1981). Domicide therefore can occur in a more subtle form than violent destruction only. Relocating elderly people for example into a retirement home often involves a reduction of household items and mean a serious disruption in place attachment (Brown & Perkins, 1992). Both the relocation and reduction affect the symbiosis in a negative way, and can even turn fatal.

Predation on Symbiosis

Like any life form, a symbiotic life form is part of a food chain and following the Cambridge English Dictionary definition "a series of living things that are connected because each group of things eats the group below it in the series", it is likely that most life forms are not at the top of the chain, i.e. the symbiosis of people and building can be the prey of others.

Saskia Sassen (2010) describes how in the run up to the 2008 financial crisis, sub-prime mortgages were used to create capital (by others than the occupants) at the costs of the occupants, eventually resulting in the expulsion of owners from their homes. A mortgage is a financial construct based on house-owner connection, in which the house is the collateral for a loan that allows the owner to buy the house, i.e. own it.

Summary

Symbiosis is used by the social and society to locate and identify people and thus create social structures. Symbiosis also affords the use of a building as a person's proxy, i.e. other people (and society) can target a building in order to perform an action upon a certain person. Various forms and degrees of physical and psychological violence can accompany such actions.

Formality and Symbiosis

Abstract Systems

In **What Technology Wants**, Kevin Kelly (2010) discusses the role of technology in society. In order to distinguish technology as a whole from specialized technologies like IT and aeronautic technology, Kelly introduces the term *Technium*. It designates "the society and culture of tools" and is akin to what Germans call *Technik*, and the French *technique*, as opposed to *technologie*. In addition, Kelly considers the idea of a self-reinforcing system of creation an essential quality of the technium. Technium is an entity *per se* and is of abstract and virtual character. Nowadays, we are fully in symbiosis with the technium in the sense that our life expectancy is determined by even the most primitive tools we use. Cooking food for example, functions as an external stomach processing raw food. Without it, our teeth would wear out more rapidly. Kelly's idea of technium as extension of the body is a framework to Westbroek's (2012) observation of tools as man's exchangeable organs; "The extended human is the technium".

Tools however, need not necessarily be physical objects. Administrative tools for example are abstract. Building codes and zoning plans are abstract tools for the implementation of policies. Formal property systems are tools in the capitalist economy. Similar to *technium* as container of the society and culture of tools, *bureaucracy* is the society and culture of legal structures, and *administration* that of formal systems. In **Urbanisation Unlimited**, Johannes Fiedler (2014) identifies measurement, writing, money, and norms as the four basic tools of abstraction. Fiedler sees abstraction as "the driving force in urbanization: detachment from the soil, liberation from earthy conditions".

These tools, techniques, structures, and systems are all human inventions. One will for example not find a banking system in nature. Following-up on the discussion about vernacular versus modern, technium, bureaucracy, and administration are all non-vernacular. They are not the product of the household, but an entity 'out there'. The point is, they have become independent phenomena, separate things, and as Kelly calls them "self-reinforcing systems of creation". Of course, all kind of arrangements and agreements exist in vernacular environments, but they are made and maintained by communities of natural persons. The abstract systems are more an instrument to society. Compared to community, society is abstract and the domain of legal persons.

The trend towards abstraction is visible in four ecological phases of human existence, identified by Boyden et al. (1981, cited in (Downton, 2009)). The evolution from community to society comes with changes regarding urbanization, ownership and the notion of communal – individual. Table 2 presents the characteristics of those phases.

	Phase 1 – The primeval phase	Phase 2 – The early farming phase	Phase 3 – The early urban phase	Phase 4 – The modern industrial phase
Characteristic behavior	Human populations behaving in similar fashion to other omnivorous mammals. Tribal relationships.	Domestication of animals, plants, and people. Predominantly tribal relationships.	Larger aggregations of people with 'in-group/out-group' distinctions.	Very large agglomerations of people. Alienation common.
Form of settlement	Nomadic. A few individuals.	Less nomadic. Small groups & villages.	Increasingly urban but few cities larger than 100,000.	Primarily urban. Many cities larger than 1,000,000.
Patterns of ownership	Tribal & individual possessions that could be carried.	Animals, crops, stored grains in communal ownership.	New concepts of individual & family ownership.	Private ownership & large disparities in wealth.

Table 2. Four Ecological Phases of Human Existence (adapted from Boyden et al. 1981 cited in (Downton, 2009)).

In vernacular environments, people negotiate the erection of buildings with neighbors and community members. In modern society, this negotiation process is replaced with a formal system of building permits, in which plans are checked against zoning plans and building codes. These codes include structural soundness, fire safety, healthiness, and environmental conditions. The symbiosis of people and building has become subordinate to this system. In **HOUSING BY PEOPLE**, John Turner (1976) points out that such regulations work best when they only put restrictions, and refrain from telling *how* to build, let alone *what* to build. Although much regulation today indeed follows Turner's recommendation, it is inevitable that for example energy saving policies have their effect on the composition of the façade. In **TIGHT SPACES HARD ARCHITECTURE AND HOW TO HUMANIZE IT**, Robert Sommer (1974) argues that bureaucracy causes hardening in architecture and alienation in people. His concern is about the un-intentionality of the phenomenon: "what is being discussed here is not space that is consciously designed to keep people apart, but space that works that way when the goals of the building are otherwise. Architects do not bear the major responsibility for the existence of bureaucratic buildings. Almost by definition these are buildings that belong to no one, neither the people who work in them nor those who built them." Turner's observation also suggests that the various stakeholders in construction and use of a building each pursue their own goal and communicate too little. The result is something that nobody intended.

An example of how bureaucracy can take physical shape in a building is shown in Photo 14. Zoning plans limit the built-up area, prescribe setbacks, and set the maximum height of buildings. This set of limitations is called the envelope. As regulations and interpreting them can be complicated, so is imagining the envelope. Planners and architects have to figure out what the envelope precisely looks like and sometimes they need the help of law experts.

Photo 14. Building volumes restricted by regulations on shadow reduction and height limits. In order to comply, cut offs have been made from the more obvious square shape. The result is un-intentional. Tokyo March 12, 2007.

Envelopes can be visualised in a virtual landscape. It is a landscape of maximum volumes. In **FARMAX** (MvRdV, 1998), Koek, Maas, and Van Rijs termed this envelope-landscape *datascape*. When built to the maximum, as in Photo 14, datascape is visible in the real world.

Division of Labor

Not only bureaucracy alienates buildings from people; the division of labor has similar effects. In current construction practice, the client, designer, contractor, and builder are separate parties with each their own interests. In order to reach maximum profit for all, costs are reduced by streamlining the production process, i.e. making it as linear as possible. The common strategy is to make detailed plans in the design phase in order to avoid changes and adjustments in the execution phase. Changes disturb the process and cause additional costs and delay. All parties gain from avoiding changes in a later stage. Decisions therefore must be made as early as possible in the project. As a result, decisions are based on abstractions like drawings, calculations, renderings, and perhaps scale models. Howard Davis (2008) points out that architecture as a profession of designing buildings came only into existence as a split off from the process of building them, in the wake of the 19th century industrial revolution.

In **A VISION OF A LIVING WORLD**, Alexander (2002a) stresses the importance of building as a process *by all*, that affords trying out in the real world and adjustment of plans in a rather late stage. The pattern of such a process is the contrary of linear. All people are involved synchronously and try-outs may produce results that justify revision of earlier decisions. Decision-making on form with the use of 1:1 scale mock-ups on the construction site mark Alexander's projects. In societies where the

efficiency of the production process dominates construction, Alexander's approach is hardly affordable. Since form decisions have serious effects on time and costs, they are usually taken in an early stage, often long before the site is accessible. The modern production process is such an entity on itself that, similar to building codes and zoning plans, it inhibits design decision-making in the context of reality (H. Davis, 2008).

In LEARNING FROM VERNACULAR, Pierre Frey (2010) introduces New Vernacular Architecture as term for contemporary architecture that manages to escape the divisions typical of today's building process. Architects Anna Heringer in South-Asia and Carin Smuts in South Africa manage to embed their Western-educated professionalism in the local community's building practice. Bijoy Jain in India sees his own artistic input in the design become less important and regards every design the result of dialogue with the artisans. Sketches and 1:1 mock-ups of details are at the heart of that dialogue. Most handmade drawings are on 1:1 scale in order to stay close to reality. The main purpose of CAD-drawings is to afford transmission by e-mail to authorities.

Commodification

The formal dimension of symbiosis also deals with the aspects of ownership, property, and capitalization. As explained earlier under Theoretical Framework, Illich (1983) characterizes vernacular as the inverse of commodity. The action of turning an item into a commodity hinges on the distinction between *value of use* and *value of exchange.* A vernacular item has value of use, whereas commodity is all about value of exchange. Money is an intermediary in trading one commodity against another. Douglas Rushkoff defines this *commodification* as "a somewhat Marxist idea, referring to the way that market values can replace other social values, or the way a market can replace a communal system" (Rushkoff, n.d.).

Economist Hernando de Soto (2000) explains how formal structures afford capitalism. Assets normally used for daily life can have a parallel life as a commodity. In any country, one can see houses in use for shelter, land in use for harvesting, and merchandise being bought and sold. In developing and former communist countries, assets serve mainly such primary purposes. In the West however, these assets have a parallel life as capital, independent of the physical world. Formal property systems facilitate this commodification. Houses can be used as collateral for loans, allowing entrepreneurs to start new businesses and thus create new capital. Property and individual ownership are key factors in commodification and the production of capital. Assets serving their primary purposes of use are *dead* capital, whereas *live* capital stands for their parallel life as a commodity, affording offspring capital.

Pierre Frey uses Illich' definition in order to define vernacular architecture as the opposite of design architecture. In LEARNING FROM VERNACULAR, Frey (2010) describes a logic about vernacular architecture that has parallels with De Soto's logic about the

creation of live capital. Both authors refer to the distinction of *use* versus *commodity*. According to Frey, the mechanism that moves architecture from vernacular to commodity is industrialization. De Soto's mechanism of property systems plays a similar role in commodification. The resemblance of the pairs *vernacular – design* and *assets – capital* is visualized in Diagram 2.
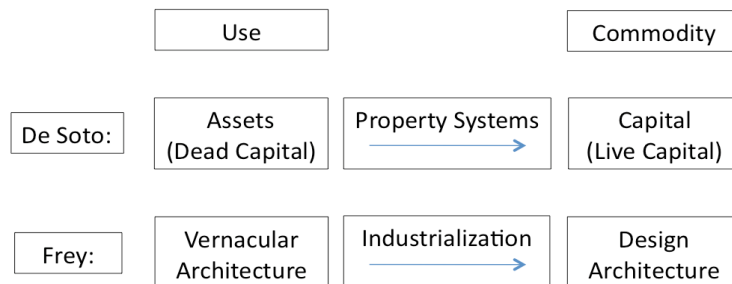

Diagram 2. Use and Commodity in Economics and Architecture.

The indiscriminate nature of commodification contributes to the un-intentionality found in Sommer's mention of bureaucratic buildings (page 74). Frey describes the mechanisms of 'design' as a phenomenon that is now having a life of its own: "a religion nourished by its own propaganda". The processes and effects of the transition towards design architecture are mainly those of the division of labor and the subsequent alienation of the artisan and his work. Frey points at the many qualities that got lost in this transition, and his book aims at bringing back the qualities of vernacular architecture into the architecture of today: "The aim is to distinguish the practices that most radically and clearly prioritize respect for human criteria (individual and social), for the environment and for architecture." An essential ingredient of (new) vernacular architecture is 'relation': the relation of the end-user with the building; the relation of the builder with the building; the relation of the construction-site with the construction process; and the relation of the production process with the social context. The division of labor, industrialization, and commodification compromise these relations. In its most basic form: in order to sell a building, man has to disconnect from it. Turner (1972) and Dovey (1985) likewise argue that commodification, i.e. treating housing as a commodity, is a major obstacle in the process of the dweller's personal identification with the building.

De Soto's research has shown that adequate property systems facilitating the uncoupling of use and commodity are key factors in the success and failure of capitalism. Moreover, as Drucker (1996) points out in **THE CHANGED WORLD ECONOMY**, uncoupling between financial markets and the real economy of goods and services is part of a wider trend of uncoupling, which includes the uncoupling between the raw materials economy and the industrial economy, and similarly between low labor costs and manufacturing production. This uncoupling is a division of formal systems, much like the division of labor.

The User

Just like functionalism introduced functions for rooms and thus segregated everyday life into distinguished activities, it also categorized people in order to fit this segregation. 'User' was one of the last words to appear in modernist vocabulary and its application became widespread no earlier than in the 1960s.

In THE PRODUCTION OF SPACE, Henri Lefebvre (1997) argues that the term 'user' is part of the abstraction typical of modern societies, in which both space and inhabitants are modeled to fit with the dominant way of production.

In architecture, the definition of user as "a person or persons intended to occupy the work" is intentionally generic since its purpose was to strip it of the human connotations found in 'inhabitant', 'occupant', or 'client' (Forty, 2000).

Jonathan Hill (2003) explains that not all three types of users (as distinguished on page 47) submit themselves to the dominant way of production. "The *passive* user is predictable and unable to transform use, space, and meaning. The *reactive* user modifies the physical characteristics of a space as needs change but must select from a narrow and predictable range of configurations largely defined by the architect. The *creative* user either creates a new space or gives an existing one new meanings and uses." The behavior of the creative user is closest to vernacular, whereas the passive user is a mere consumer.

The commodity perspective also affords distinction of several modes of symbiosis. For an owner, the building he purchased as a commodity can soon become a personal item. A tenant for example will not own or possess the building; it remains a commodity. The tenant's personal share is limited to *use as a place to put the household*. For a guest in a hotel, everything up to the tiniest household item remains commodity.

Like the worker on the construction site who is alienated from his work, also the end-user is affected by an alienation from the built environment. A counter movement is visible in the emergence of do-it-yourself stores that facilitate the end-users to adapt and correct the products of the construction industry (Frey, 2010).

Counter Movements

As opposed to financial and economic capital, the term social capital "refers to the collective value of all 'social networks' and the inclinations that arise from these networks to do things for each other" (Putnam, 2000). Typically, social capital plays an important role in the non-commodified world. Unlike the emphasis on individual property in capitalism, social capital is based on common interests, communal ownership, and convivial economy. Putnam points out that "the touchstone of social capital is the principle of generalized reciprocity - I'll do this for you now, without expecting anything immediately in return and perhaps without even knowing you, confident that down the road you or someone else will return the favor" (Putnam, 2000). Whereas vernacular and commodity are each other's counterparts, social capital

is not limited to convivial communities or the informal economy. It is thoroughly embedded in capitalist settings too, where social structures like the old-boys'-networks are of critical importance. Social Capital Assessment Tools (Krishna & Shrader, 1999) are being made to quantify social capital, partly in order to afford exchange with financial capital. The major obstacle in such attempts is that factors like 'trusting' and 'benefiting' are subjective and context dependent qualities. These are hard to assess and quantify. Moreover, the intention to quantify can be mistaken for an intention to commodify.

Wild Dwelling

Architect and former president of the Dutch Association of Architects Carel Weeber got so annoyed by the ubiquitous order in The Netherlands he called for a radical new direction in HET WILDE WONEN [Wild Dwelling] (Weeber, 1998). After proclaiming the end of public housing and giving a survey of (what is left of) informal dwelling, Weeber suggests to focus on personal housing, an initiative to create housing and environments for an emancipated population in an open market. In ("AVRO Close up," n.d.), Weeber argues that the principle of order goes that much at the cost of freedom that, ordinary people are not allowed to do anything regarding dwelling. Building one's own house has become almost impossible. Professionals heard Weeber's call and embraced it, but as Weeber finely points out, the institutions typically started to arrange and organize *Het Wilde Wonen*, contrary to its intention towards disorder. Weeber's *Wilde Wonen* is a statement against the nationwide urban planning version of Sommer's 'bureaucratic building'. Regarding commodification, Weeber suggests a model in which the building industry creates building systems that afford personalization of the house design by its clients. Regarding the existing public housing stock, Weeber suggests simply to give it away to the tenants: "There are people who have been paying rent for thirty or forty years, give them the house, they have already paid for it."

Informal World

'Informal' as a classification finds its origin in 'Informal Sector', which was coined in THE KENYA MISSION 1972 REPORT by the UN International Labor Organization. The informal sector idea originated from the work and staff of Institute of Development Studies of the University of Nairobi, i.e. from the thinkers and analysts of the Third World themselves, not from higher circles in ILO (Bangasser, 2000). Informal housing is a product of the informal economic sector. In brief, "Production units of the informal assets used do not belong to the production units as such but to their owners. [...] Household enterprises are units engaged in the production of goods or services which are not constituted as separate legal entities independently of the households or household members that own them, [...]" (Bangasser, 2000). This description also makes clear that informal not necessarily equals illegal, since informal means not

making use of certain legal systems. De Soto uses the term extralegal to distinguish the concept of informal activities from the deliberate illegal underground economy (de Soto, 2000).

In **THE OTHER PATH,** De Soto (1989) was the first to honor the way the informal economy works, based on research in the squatter communities of Lima. He argues that squatters could break out of poverty if only they could get bankable title to their shacks. As a strategy to fight poverty, he suggests to allow the extralegal, the informal, access to the systems of formality. De Soto leaves it open *if* people should move to the formal sector. His thesis is that capitalism can only function in environments with adequate property systems. If people are to have access to capitalism, they need access to formal systems. Robert Neuwirth, who claims that such strategies mostly do not work in urban slums, challenges De Soto's strategy. In **SHADOW CITIES,** Neuwirth (2005) wrote: "It doesn't matter whether you give people title deeds or secure tenure, people simply need to know they won't be evicted. When they know they are secure, they build...", thus leaving the path open for the informal society to solve high-density urban development issues, not to say for people-building symbiosis. Support for Neuwirth's argument is found in **THE CHALLENGE OF SLUMS** (UN-Habitat, 2003) where it says that "It is now recognized that security of tenure is more important for many of the urban poor than homeownership, as slum policies based on ownership and large scale granting of individual land titles have not always worked." In **HOW SLUMS CAN SAVE THE PLANET,** Stewart Brand (2010) takes the potentials occurring in informal settlement even further and presents them as an important source in thinking about a green alternative for urban planning. Moreover, this is essentially a call for a re-appreciation of people-building symbiosis.

The *Kinetic City*, as termed by Rahul Mehrotra, is the city of living, using, the users, adaptation, and festivities, unlike the *Static City* of planners, urbanists, architects, and engineers. The Static City is built of permanent materials like concrete, steel, and brick; it is the permanent part of the city and it affords the making of conventional city maps. It also affords monumentality. The Kinetic City is as a city in motion – a three-dimensional construct of incremental development. The Kinetic City is "temporary in nature and often built of recycled material: plastic sheets, scrap metal, canvas, and scrap timber. It constantly modifies and reinvents itself. [...] [And] suggests how spatial limits are expanded to include formally unimagined uses in dense urban conditions" (Mehrotra, 2009). The static city is the domain and product of the formal world, whereas the kinetic city is more informal.

Ownership

As discussed above, commodification is closely linked to property and ownership. In the Western world, ownership is the exclusive relationship of a person (or a group) with a certain building. The building is territory under the stewardship of its owners. Ownership is not limited to an individual person. A family, community, government,

legal structures et cetera can all exercise ownership. Combinations occur too, for instance, when a family member buys a bicycle that is henceforth family property. Ownership is a characteristic granted to someone by the people around him and it can only exist as long as others recognize it. Formal property systems serve to secure this recognition and to avoid dispute. Formal property is a legal structure, which replaces agreement between natural persons. In Western societies, ownership predominantly means property.

	Use	Ownership
Dwelling as use	Shelter	Communal
Home as use	Home	Household
Living as use	Owner dweller	Individual
Renting as livelihood	Tenant dweller	Natural Person
Living as commodity	Tenant dweller	Legal Person
Stay as commodity	Guest	Hotel
Dweller as commodity	Quid pro quo [8]	Developer

Table 3. Steps in the commodification of the dwelling and the dweller.

Table 3 shows the gradual move from communal to formal ownership. Vernacular environments allow communal ownership. Since vernacular is the product of the household, no individual ownership is directly required. The individualistic interpretation of ownership is a key factor in capitalism. Next, use can be commodified and even ownership itself. The effect of commodification on symbiosis of people and building is visible in this commodification of use and ownership. The individual becomes owner and eventually turns into a commodity himself.

In this range, the influence a person has on his building is diminishing. In the first three stages, a person is still in a live symbiosis, like the owner dweller. The next, the tenant dweller, is already a situation where both dweller and house are reduced to commodity. Their relationship is a commercial one.

Appropriate Technology

The phenomenon of alienation was particularly hard felt in developing countries where advanced technology was introduced as development aid. The idea was to save time by skipping time-consuming gradual development. The result however, was an economic divide between the rich who could afford the capital intensive advanced technology and the poor who remained with their traditional techniques. The Appropriate

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[8] The example of developers building free of cost housing for the poor in exchange for transferable FSI is explained in chapter Slum Redevelopment Programs, page 276.

Technology movement aimed at introducing techniques that fit better with the status quo and would allow gradual development. Although such 'less advanced' technology would require more labor (i.e. jobs) for the same production, the effect would be a better spread of wealth in society (Akubue, 2000).

Effects of Commodification on People and Building

The involvement of people in production ranges from building for their own use (owner-builders), to building a structure that is destined for the market (commercial builders). Vernacular builders are those who build in a demand driven one-on-one relationship with the owner. They may contract their services in a market –style competition; the execution however, is directly linked to the owner/client. This also means that an owner-builder is automatically a vernacular builder. For commercial builders, building is a commodity destined for the mainly supply driven market. Typically, the client is not the intended end-user/occupant.

The design of commercial building is subject to the economics of scale and fashion. Large-scale production and replacing labor by mechanization affords keeping costs low. Industrial production requires repetition and standardization, which is inevitably recognizable in the resulting building. Architects and designers spend much of their time on engineering, i.e. fitting construction systems together into a design that is sufficiently fashionable to make the project commercially feasible. Since the needs and taste of the actual end-user are unknown, the design and aesthetics of the building must follow fashion and average programming. In vernacular settings, the project is typically demand driven, i.e. with explicit knowledge of the end user's aesthetical preferences and program.

Summary

The formal dimension is the domain of the virtual. It holds abstract systems, legal persons, the technium, property systems, legislation, commodification, the planned city, the market, and intellectual abstraction. It shapes buildings by means of rules, not by physical criteria. It channels human behavior through laws and policies, not by mutual feedback in face-to-face situations. It designates the inverse of natural persons, the building practice of the artisan, social behavior in communities, communal ownership, or convivial exchange of goods.

The formal dimension therefore designates foremost a contextual part of symbiosis. It contains intellectual artifacts and abstract systems. Phenomena like 'informal sector', 'social capital', and 'Wild Dwelling' are indicative of the frictions between symbiosis and its formal context.

Summary Model of the Symbiosis

	Personal	Social	
Behavior	**People and Symbiosis** Perception Operation Embodiment Personalization Place attachment Adaptation, adoption Existential, passage of time Extension of the body Connection with Self	**Society and Symbiosis** Identification Homelessness Nomadism Imprisonment House arrest Eviction Domicide Squatting Autonomy-heteronomy	*Interaction with other people*
Building as artifact	**Building and Symbiosis** Construction of building Production Incremental Accretion Generation Creation Operability Affordance	**Formality and Symbiosis** Technium Abstraction Commodification (Extra-) legality Property rights Accountability Formalization Ownership	*Intellectual artifacts*
	Material	Formal	

Table 4. Model of the four dimensions of symbiosis.

Table 4 is a summary of the four dimensions. The top half of the table covers people, whereas the lower half is about artifacts. The left half covers the physical world of people and building, the right half is the domain of the virtual, interaction, events, and the kinetic.

The two-dimensional display in Table 4 unintentionally suggests little interface over the diagonals. The four dimensions obviously relate equally to each other. A more adequate visual presentation is Diagram 3.
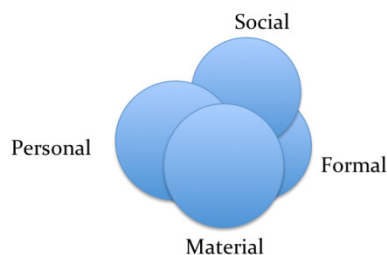
Diagram 3. Dimensions of symbiosis relate equally to each other.

The purpose of this model is to provide various dialectics in order to examine the nature and structure of symbiosis. The model can also serve to display the position of fieldwork cases in relation to these dialectics. Informal settlement for example, brings an image to mind as in Diagram 4. Findings from the research will be discussed within the conceptual framework of these four dimensions.
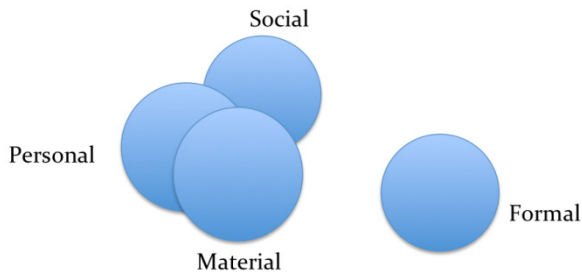
Diagram 4. Conceptual representation of informal settlement.

This Study's Contribution to the Literature

The above review of literature and theory shows that many detailed aspects of the relationship of people and their buildings are known. This knowledge however is dispersed over several disciplines, and for various reasons fails to reach others. The proposed model aims at facilitating a cross-disciplinary approach by providing (1) a focal point and (2) a conceptual framework. The symbiosis of man and building is the focal point; the four-dimension model the conceptual framework.

This way, the research will provide a new focal point in architecture and environment behavior studies. It will also provide an anchor point in holistic thinking about the built environment and help to identify potential pitfalls in development strategies and 'sustainable' design. As a tool, it is an add-on to SWOT-analysis methods (Strength, Weakness, Opportunities, and Threats).

Research Procedures for Fieldwork

Research Methodology

Since the aim of this thesis is to build theory regarding symbiosis, and the literature only touches the topic on the side, the main strategy of research is Grounded Theory. This can be understood as building theory 'from the ground up' or in the words of Graham Gibbs: "Its central focus is on inductively generating novel theoretical ideas or hypotheses from the data as opposed to testing theories specified beforehand. Insofar as these new theories 'arise' out of the data and are supported by data, they are said to be grounded" (G. R. Gibbs, 2007).

Regarding the use of research methods, Saskia Sassen (*Sassen*, 2013) argued that a balance must be kept of method *vis-à-vis* focus on the topic of the research. Sassen suggests an approach of 'Before method': "Suspend method in social sciences! Method is a discipline meaning all kind of things you want to do, you cannot do." As a tactic for analysis, Sassen recommends "the freedom to position myself *vis-à-vis* the object of study the way I want, not disciplined by method, but disciplined by the hard work of trying to detect what is going on." The purpose of taking this freedom is "destabilizing stable meanings" and finding "what is hiding in the shadow of powerful meanings? E.g. what does the powerful category of 'immigration' keep us from seeing about immigration?" In a sense, Sassen points out the importance of formulating a strong and adequate research question. This chapter will describe the application of several methods and strategies, among which is giving room to serendipity. This diversity bears the risk of losing track, and it is therefore that clear-cut research questions where used for navigating (guided) conversations. Collected data and occurring opportunities can simply be tested against this research question. After all, research methods can only follow from research questions.

Where possible, ethnography was chosen as research approach, since a considerable part of the symbiosis of people and building is determined by how people *experience* their building. An important notion in ethnography is participant-observation in which the ethnographer immerses/participates in the situation in question. By doing so, the researcher can get access to not only what participants *do* but also to what they *experience* (Dourish, 2001). It is the ethnographer's intention not to bring assumptions or orientations into the environment under investigation. Sassen's call reflects the ethnographic approach.

Sampling

Initial Sampling

The initial questions this thesis seeks to answer about the symbiosis of people and building are *what* it is and *how* it works. The basic principle in the research method then is to investigate the phenomenon of symbiosis in several different settings, i.e. to look at symbiosis against different backgrounds. These backgrounds range from vernacular to modern. This range affords investigation of historical trends as well as geographical differences. In order to cover the central research question of how symbiosis evolved in the transition from vernacular to modern environments, three types of settings were defined (vernacular, transition, high-tech) in which several contexts (cases) will serve as samples for the research. Initially, the three contexts were as follows.

1. Vernacular settings: rural traditional architecture and urban informal settlement.

2. Transition settings: New Vernacular Architecture where contemporary professional architects combine their expertise with vernacular strategies.

3. High-tech settings: consisting of state of the art high-tech buildings.

As the researched developed however, it turned out that New Vernacular Architecture yielded too little information, whereas informal settlement appeared to be a case of transition rather than of traditional building. The framework for sampling was therefore changed into:

1. Vernacular settings: rural traditional architecture in India.

2. Transition settings: modernizing villages and urban informal settlement.

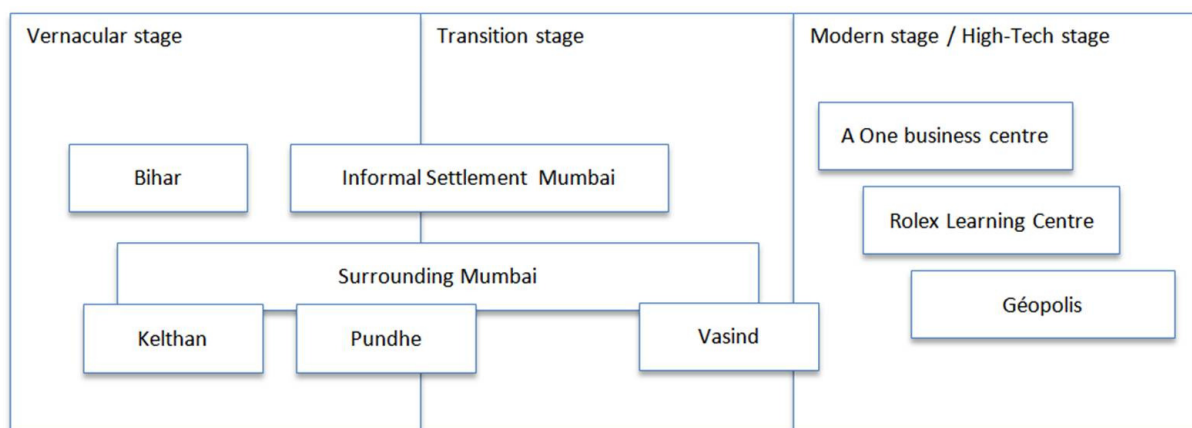3. High-tech settings: consisting of state of the art high-tech buildings.

Diagram 5. Multiple case design with embedded multiple units of analysis, after (Yin, 2009).

In these three categories, several investigations were chosen as case studies in fieldwork, following case study design and methods as described by Robert K. Yin (2009). The idea is to embed several units of analysis in one case that in itself is a unit in a bigger case (Diagram 5). The cases in Diagram 5 are initial samples. There is however, no one-on-one relation with the dimensions of symbiosis mentioned under Literature and Theory. The case studies however produced detailed insight in trends and phenomena, which eventually will be discussed in relation to these dimensions. Similarly, data display will not necessarily follow the format of the initial sampling, as will be explained below.

Theoretical Sampling

As the research progressed, concepts and categories emerged from the analyzed data and studied literature. These concepts and categories where then used in further, more refined, sampling. In CONSTRUCTING GROUNDED THEORY, Kathy Charmaz (2010) describes this as *theoretical* sampling since it results from the emerging theory. This may sound abstract, but it was tangible in the practice of the fieldwork. As described in the chapter Treatment of the Data (page 95), photos were categorized and coded shortly after they were taken. This categorizing and coding gave rise to concepts that wrapped up earlier findings and asked for examples that are more pertinent. The next day, the focus of the sampling was different. In a similar way, interviews gave rise to new ideas on whom to interview next (e.g. a certain expert) or about what (e.g. a new insight). The replication of certain homes in 1:20 scale models raised questions about all kind of household items (see Scale Models on page 96).

Since the development from vernacular to modern is one that takes place over long time, the investigation would require a longitudinal study lasting several decades, if not centuries. In order to avoid a too lengthy investigation, the research made use of the fact that most stages of development are visible today, provided one accepts a geographical spread. In other words, it is possible to study the pre-modern age by going to a pre-modern area.

Cases of Vernacular and Transition

For the vernacular settings and the settings in transition, a country was chosen where formality and institutionalization are still low, i.e. what is commonly known as a developing country. India was selected for practical reasons such as a low language barrier (English is spoken in most strata of Indian society), and the author being familiar with the location, logistics, culture, and practicalities of communication.

Cases for the *vernacular* context are towns and villages around Mumbai: Vasind, Pundhe, Manor, Kelthan, Tara, and several hamlets near Kumma in Bihar.

Cases for *transitional* context include Dharavi and other locations in Mumbai.

In principle, the three stages mentioned above are present throughout India and many areas show a mix of vernacular, traditional, and high-tech. Nevertheless, the selection of cases was a process of purposeful sampling. Dharavi Mumbai is one of the transitional settings, as it is the largest informal urban settlement (slum) neighborhood in Asia. Dharavi is deliberately mentioned here as the first sample since it is the centerpiece of the fieldwork in India. All other samples were chosen in relation to Dharavi.

It was assumed that informal settlement is a vernacular phenomenon and that when it happens inside the (planned) city, the result must be a case of transition. Another assumption was that redevelopment schemes that aim at 'rehousing the poor' are cases of modernization. The third assumption was that by investigating the home villages of people who had migrated to Dharavi, it was possible to investigate vernacular settings as well as the process of transition.

The transition from slum dwellings to modern housing was studied in cases where a developer (i.e. the market) takes the lead as well as cases based on alternative initiatives, such as Sites & Services in Airoli (Navi Mumbai), SPARC and Mahila Milan in Mankhurd, and the National Slum Dwellers Federation in Dharavi. As informal settlement and multi-storey real estate sit next to each other, and people move from one to the other, transition is part of many a dweller's personal history.

In order to relate the observations made in Mumbai to vernacular settings, the villages of Manor, Kelthan, and Tara in the periphery of Mumbai, were studied as well. Investigation of how the house and the home change in relation to the everyday life of its occupants was set up as participatory research. The first case was in Vasind, where a home stay with a family for several weeks afforded close observation from inside. The second case was a stay with a family in a remote hamlet near Kumma in Bihar, on invitation by a man from Dharavi. Many Dharavians come from Bihar. Thus, it was possible to investigate the above-mentioned range of vernacular - transitional - modern in a coherent way, with Dharavi at the center.

Besides the home stays that afforded the participatory research, accommodation in India was deliberately chosen in hotels and guesthouses of varying character. In smaller accommodation, it is easier to establish contact with the people running the place, certainly when investigating their perspective on how the building plays a role in their lives and the lives of the guests.

Expert interviews were conducted at Sir JJ College of Architecture and the Tata Institute of Social Sciences (TISS) in Mumbai. Among other interviewed professionals were architects, builders, developers, anthropologists, and community leaders.

Besides the settings described above, interviews were conducted in occasions that occurred randomly. As all people live in a home and most work in some place, everyone has experience with buildings and is a suitable informant in an interview.

Thus, spontaneous interviews took place at kiosks, restaurants, lobbies, trains, airplanes, et cetera. Written records of such impromptu interviews were made on the spot or shortly after.

Urban Informal Settlement

Photo 15. Urban informal settlement engulfing modern housing blocks in Mumbai. January 9, 2010.

Spontaneous settlement is widespread in Mumbai. It is considerably different from spontaneous settlement in villages as the setting is urbanized and most building materials find their origin in the industrialized environment, unlike the more natural environment of villages. Due to these conditions, urban spontaneous settlement is a typical case of transition from vernacular to modern. As shown in Photo 15, spontaneous settlement (also referred to as informal settlement) often sits close to planned building and people move from one to the other and back.

Slum improvement and redevelopment schemes try to improve the living conditions of the poor. They often come with a radical change in the way of living, including major shifts in the inhabitant's interaction with the building. This shift often comes with an increased dependence on market-driven activities that are detrimental to solidarity and social cohesion. The change in lifestyle can be stressful and is a potential source of social problems in redevelopment projects (Fried & Gleicher, 1961). A comparison with improvement schemes in tribal villages was made in order to see if appreciation of user driven operation contributes to a smoother transition.

One of the known problems in rehabilitation projects is the loss of space used for livelihood. Ground bound dwelling facilitates economic activities that cannot exist in high-rise housing blocks. Such activities are an example of interaction with buildings and the use of a building as a utensil or tool.

Photo 16. Rehousing project for slum dwellers. Note the distance of only a few meters between the blocks. Parel Mumbai, January 20, 2012.

Symbiosis in High-Tech Settings: Technological Maximization

The concept of technological maximization is explained by Kenneth Frampton (1998), in discussing the schism between craft-practice and industrial technique. Frampton calls for a hybrid approach and points out that

> ... the antithesis between technological maximization and the creation and maintenance of the *place-form*, is found in how the maximization of one technique sometimes necessitates the equally excessive use of another. For example, the use of air conditioning is in part a compensatory response to automotive noise and petro-chemical pollution. (Frampton et al., 1998).

Moreover, technological maximization can lead to a de-contextualization of applications, for example curtain wall facades in unsuitable climatic situations such as in India. This de-contextualization spreads out to the user, which brings us to the untouchable building syndrome. Technological maximization comes with a maximum disconnection of building and user and thus affects the bonding with the habitat.

As the applied techniques are state-of-the-art and the setting is highly formalized and commodified, one can expected that such buildings be on the extreme of the 'In touch – Untouchable' scale. Users/occupants probably have little options to adjust the building. Interaction is limited and, indeed, windows are not operable. Interaction is limited to the adaptation of humans, who 'have to get used to it'. This means that in interaction, adjusting the environment as a way to reduce stress is not an option.

Such forced adaptation might even be counterproductive and lead to more technological maximization. A study by Liao & Cech (1977) shows that long term exposure to air-conditioning can lead to maladaptation to heat. Combining this

observation with the concept of Untouchable Building Syndrome might mean that reduction of interaction leads to laziness of human adaptation capabilities. Users must grow to understand the building to the degree that they can cope with it (Canter, 1974). This process is frustrated by deprivation of interaction in operating the building.

This research can potentially contribute to the concept of domotics[9] since mismatches between the technical concept and the behavior of users may come to the surface.

Amos Rapoport (1987) hints at such mismatches when he points out that a lesson to be learned from traditional buildings and settlements is that

> ...the relative importance of comfort, however defined, vis-à-vis other considerations may also vary, i.e. privacy, status, identity, life-style, belief systems, social relations and many others, including latent functions, may be more important than climatic response or energy efficiency. This means that energy research generally must look at life-style, behavior, and images as well as technology and 'design'.

Therefore, the implications of domotics on the way of living (as perceived by inhabitants) and more specifically on interaction, need more attention. The aim of this case is to reveal how the subjects (users, architects, engineers, and builders) interpret the importance and value of user-driven operation (e.g. is interaction desirable or not?). The research aims at constructing a shared understanding with the subjects of the role of interaction, user-driven operation, and adjustment of buildings.

Cases of High-Tech Autonomous Buildings

In addition to the cases in India, several buildings in highly formalized Switzerland served as cases for high-tech settings. Besides the high degree of formality and institutionalization, the research aimed at buildings with a high technical autonomy, i.e. buildings that require little operational activity from occupants.

Cases:

A-One Business Center, a contemporary office building of generic design;

Rolex Learning Center EPFL, a library building of high profile design;

Géopolis UNIL, an academic building of state-of-the-art design.

Subjects:

End users, facility managers, and people from the project team e.g. architects.

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[9] **Domotics** is a composite of *informatics* and the Latin word *domus,* or a contraction of *domestic robotics.* It refers to *intelligent houses* meaning the use of automation technologies and computer science applied to the home.

Instrumentation

For literature research:

      Zotero reference management software.

For surveys of buildings and built environments:

      Notebook, pen, sketchbook, pencil, eraser;

      Digital camera Nikon S6000;

      Digital camera Nikon D50.

For treatment of photography-data:

      Adobe Photoshop Elements 7 organizer;

      Adobe Photoshop Elements 7 editor.

For interviews:

      Question matrix as suggested by Kaufmann (Kaufmann, 2011).

      Notebook, pen, pencil, eraser;

      Audio recorder Tascam DR-07mkII;

      Digital camera Nikon S6000.

Data Collection

Interviews

Interviews were conducted in the form of guided conversations following the method described in L'ENTRETIEN COMPREHENSIVE (Kaufmann, 2011). The method aims at creating a comfortable environment in order to have the informant produce as much relevant information as possible. Instead of using a questionnaire, which will produce answers to the prepared questions only, a guided conversation affords broader interpretation of the informant's experience with the matter. The interviewer allows the informant to tell the story and will guide the conversation along topics prepared in a matrix. This matrix affords control over the matter that is covered, but leaves room for flow in the conversation and thus creates an atmosphere that yields most data.

Building Survey

The survey of the symbiosis elements in the Rolex Learning Center was conducted using a method designed by prof. Paolo Tombesi which focuses on innovative dynamics in iconic buildings (Tombesi, 2008, 2012). See for further description page 296. Surveying A-One Business Center and Géopolis was more straightforward as both are technically of generic contemporary design.

Photography

In architecture, photography is mainly used for action research, referencing, and representation. Action research is for example, mapping the current state of a future

construction site, documenting construction progress, mapping restrictions other disciplines may have to deal with, or documenting issues that occur during execution. Referencing is part of making design choices with the client. Representation is the resulting building shown in publications. In representation, the aesthetic quality of the photography itself is an important factor.

Photography as a research instrument is described by photographer Hans Aarsman in DE FOTODETECTIVE [The Photo-Detective] (Aarsman, 2012). With his background in journalism photography, Aarsman explains that besides conveying a story to the reader, the purpose of a photo is also to identify issues and isolate them from a potentially concealing context. Detailed examination of a photo can raise additional questions for the reporter/photographer, hence the title of his book. In this research, photography is used in Aarsman's way, but also in a way comparable to the use of microscopes and imaging technology by biologists. Samples of symbiosis elements are photographed and categorized. Imaging technology is a tool for more detailed analysis of the image, for example by cropping or applying lighting effects. Thus, certain elements become more prominent. Factuality of the content of the image is the most important. For data display however, aesthetics are important too. Just like a well-written text is more convincing, so is good photography. Ideally, a photo is self-explanatory.

One of the challenges in using photography as a research tool is the fact that some people (i.e. subjects) perceive it as intrusive. Especially in environments that are close to the private domain, taking pictures is not readily appreciated. A way to get around this problem is to leave camera and notebook in the bag and first engage with people in small talk. Only after communication is established, one can guide the conversation towards the aim of the research. Later the camera can be brought out while asking if they wouldn't mind you taking a picture, which will even go smoother when the first picture is a portrait of the subject with the researcher. Keeping the camera out of sight as long as possible even resulted in situations where people asked carefully if perhaps the researcher would be willing to take some pictures.

Engaging with People, the *Tactic of Take and Give*

An important follow-up of this approach is the *Tactic of Take and Give,* developed during the pilot study described on page 99. The core idea is to compensate for *taking* a picture by *giving* a print in return. When this tactic was applied in Dharavi, before long news about this way of working spread by word of mouth. People even began to ask to have pictures taken. Besides the easy opening of new conversations that followed from this, perhaps more valuable were the hurdles that had to be taken to get the print to the portrayed person. Since printing facilities were not available on site, it took at least half a day to produce a print. Since in informal settlement no readily usable address systems exist, finding the right person again required frequent asking

around. These search actions created opportunities for engaging with new subjects. On the way to the target person, besides physical access to back alleys and remote areas, access was obtained to information about for example social structures, family connections, political or religious co-existence, and segregation.

In addition to this tactic, photos were used as conversation pieces for constructing a shared understanding. This is the idea behind *interpretive research.* By discussing the photos with local people, more background information was found. Similarly, sketching was a means to engage with local people.

Engaging with People, *Sketching Together*

As all architects know from action research, sketching is a powerful research tool. The transfer of what is seen through the pencil on to paper is like "touching with the eye" (Pallasmaa, 2009). Accurate drawing requires rigorous looking. One cannot draw a detail unless one has seen it, whereas a photo can be taken blindfolded. Sketching *is* analysis; whereas a photo is raw data (see Drawing 1 and Photo 17). As research methods, sketching and photography are therefore not exchangeable.

Drawing 1. Accurate sketching requires intense seeing and draws from analysis. January 6, 2013.

Photo 17. A photograph provides abundant raw data, requiring analysis. January 6, 2013 SdM

Similar to the *Tactic of Take and Give,* sketching turned out to be an effective facilitator of conversation with bystanders. Especially children were curious about the emerging sketches and soon engaged in the sketching itself. By following the pencil on the paper, they could see where the eye of the researcher was going. Then they started telling

stories or pointing out details. One boy kept yelling, "There are shoes, there are shoes!" whereas there seemed to be no shoes anywhere. He pointed in the drawing and indeed somewhere on top of a shutter box sat several shoes, put there by the tenants of the first floor. Other bystanders explained how the rooms behind the facades were interconnected and in which order things were built.

Treatment of the Data

Coding

For qualitative analysis of the data, a system of coding and memoing as suggested in QUALITATIVE DATA ANALYSIS by Matthew B. Miles and A. Michael Huberman (1994) and in ANALYZING QUALITATIVE DATA by Graham Gibbs (2007), was used throughout the research. This method affords both the construction of grounded theory (the symbiosis model) through theoretical sampling, and the testing of emerging theory in fieldwork. The following three brief descriptions explain the technique of coding.

> "*Codes* are tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study" (Miles & Huberman, 1994). The process of coding is described as "*Open coding:* where the text is read reflectively to identify relevant categories." (G. R. Gibbs, 2007).

> "[A *memo* is] the theorizing write-up of ideas about codes and their relationships as they strike the analyst while coding..." (Glaser cited in(Miles & Huberman, 1994)). In this research, for the purpose of clarity, memos were as much as possible written in the style of a definition.

> *Axial coding* is where categories are refined, developed, and related or interconnected (G. R. Gibbs, 2007).

> "*Pattern codes* are explanatory or inferential codes, ones that identify an emergent theme, configuration, or explanation" (Miles & Huberman, 1994). Gibbs (2007) uses the term *Selective coding* for the process of identifying the central category that ties all other categories in the theory together into a story.

Coding is an essential tool in data management, reduction, and analysis. The research strategy for this thesis aims at full use of automated data management systems, and since more than one system is required; synchronization is essential. In order to be optimally compatible with current academic facilities and conventions, data resulting from literature research is managed with Zotero reference management software. Notes of fieldwork and interview records are similarly managed in Zotero. Photos, videos and other images are managed with Adobe Photoshop Elements Organizer.

As pointed out by Miles and Huberman, codes are markers and tags that help categorize data. Since both Zotero and Photoshop Elements provide tagging tools, they afford coding and thus, more general, data management. In the literature research,

keywords and concepts are useful codes. It turned out that quite a few references downloaded into Zotero came with some tags already attributed. For the photography, codes were chosen as much as possible identical to the ones used for literature, vice versa. Thus, one comprehensive coding system was established.

As mentioned in the discussion about the definition of vernacular (page 15), the unit of analysis in the fieldwork is preferably an environment (understood as the combination of a building and its context). The above-described tagging system is suitable for absolute terms, whereas, as argued by Rapoport (1990a), "environments need to be classified in relative, i.e. comparative terms rather than in absolute terms". This approach is more refined than open coding and requires some form of axial coding. However, to use the tagging tools to position a sample in a comparative range would be unpractical since it might require a potentially infinite number of tags. Like Rapoport, Christopher Alexander (1979, 2002d) recognized the same need in the classification of subjects regarding their degree of life. Instead of attributing an absolute degree of life to units, he used pairs as samples and determined which unit in a pair had more life. By doing so, he reduced the coding set to *difference* and *no difference (between the units in the pair).* Next, he studied the properties of the samples that were positive on *difference.* In this study, a similar strategy is used when coding for the presence of a gradient in a sample. For example, a photo that illustrates the transition from *kacca* to *pucca* is coded *kacca-pucca.*

As can be understood from the above, the open coding generates the second level of pattern codes in which themes, configurations, and potential explanations emerge. Especially Photoshop Elements is suitable for pattern coding since it affords the use of categories and subcategories. Thus, tags can have a hierarchy and the process of organizing tags will lead to the discovery of pattern codes.

In the process of coding and pattern coding, more and more codes will emerge and the code-set becomes richer. Consequently, data coded in an early stage of the research may later turn out coded too poorly later. It is therefore necessary to repeat the coding process once saturation is reached in the creation of (open) codes. By reprocessing the data, more data can be identified that supports (or contradicts) early findings. In addition, more hierarchy and organization of the tags, i.e. more pattern codes, will emerge, which makes this stage more analytical than the open coding.

Scale Models

For the analysis of data found in the case of Dharavi, several 1:20 scale models were built, following a method designed by Frederic Aubry, emeritus professor at the Swiss Federal Institute of Technology EPFL. The 1:20 scale requires an elaboration in detail that is very effective for the analysis of as well the building's structure as the home interior. One of the models built for this research is of a slum student's home (Photo 20). Based on data gathered in a 360° photo survey (Photo 19), every item visible in the

photos was replicated, even pencils. Thus, all household items and their location were identified.

Photo 18. Part of Dharavi's Mahatma Gandhi Road replicated in a 1:20 scale model.

Photo 19. One of thirty photos taken in a Dharavi slum dwelling. April 16, 2013.

Photo 20. 1:20 scale model of Photo 19.

Since reproduction of an item on a smaller scale often involves the use of a different material, it was necessary to identify the purpose of the item in the household. One of the items for example was a hose of a certain length (on the right in Photo 20 and Photo 21). A simple rubber band made a good 1:20 model for it. Asking the occupants about the purpose of the hose eventually revealed the complete daily routine of water management (see chapter Water, page 140). The scale models thus generated new questions and consequently new data.

Photo 21. Replication of every item found in the data affords investigation of the whole household.

Data Reduction and Data Display

The results of the India fieldwork are written down as thematic essays and collected in a narrative order (chapter Results of the Case Studies on Vernacular and Transitional). Since the intention was to investigate how modernization is manifest in the dimensions of symbiosis and how it affects people and building 'on the ground', it was 'the ground' that provided the most adequate narrative order.

The results of High-Tech Autonomous Buildings are presented in three reports on the respective case studies on page 289 and onward.

Pilot Study

In preparation of the PhD-study, i.e. before enrollment in the EDAR-program, a pilot study in Mumbai, India, was carried out early 2010. The aims were to find a potential topic, to learn about the particularities of fieldwork research, and to generate a body of experiences that would support further education as a researcher.

The idea was to investigate how spontaneous settlement generates architecture. The main setting was Dharavi, Mumbai. In an area of 2,2 km², an estimated 700,000 people live in informal settlements. Also other, smaller, pockets of spontaneous settlement in Mumbai were visited. Additional research we did in villages around Mumbai, both rural and tribal, aimed at finding patterns that migrate to the city. The investigation was intuitive in its nature, which proved fruitful. Only later, it was found out that the way of working could be linked to professional research methods.

Data Collection

During the pilot study, data was mainly collected by observation and documented in photos. These photos became an essential tool in disclosing the more remote parts of the slums. In general, Indian people are not shy to have a picture taken of them. Therefore, documenting the first-at-hand data is easy. However, access to people's stories and the background of the architecture they produce, requires interaction that is more social. A way to engage in communication originated from what was at first a problem in itself: the ongoing *taking* of pictures felt awkward to the researcher. In order to solve this and as a matter of good manners, prints were handed to people who were in the photos. Since the printing facilities where located outside Dharavi, handing the photos to those portrayed required tracking them back a day or longer after meeting them. As the absence of addresses is characteristic of informal settlement, finding the right person requires long searches in which, fortunately, many local people offered their help. By asking around and showing the photos, additional information came available. Moreover, it opened areas that would otherwise have been inaccessible. Upon reception of the photos, people invited the researcher in their homes and shared their stories.
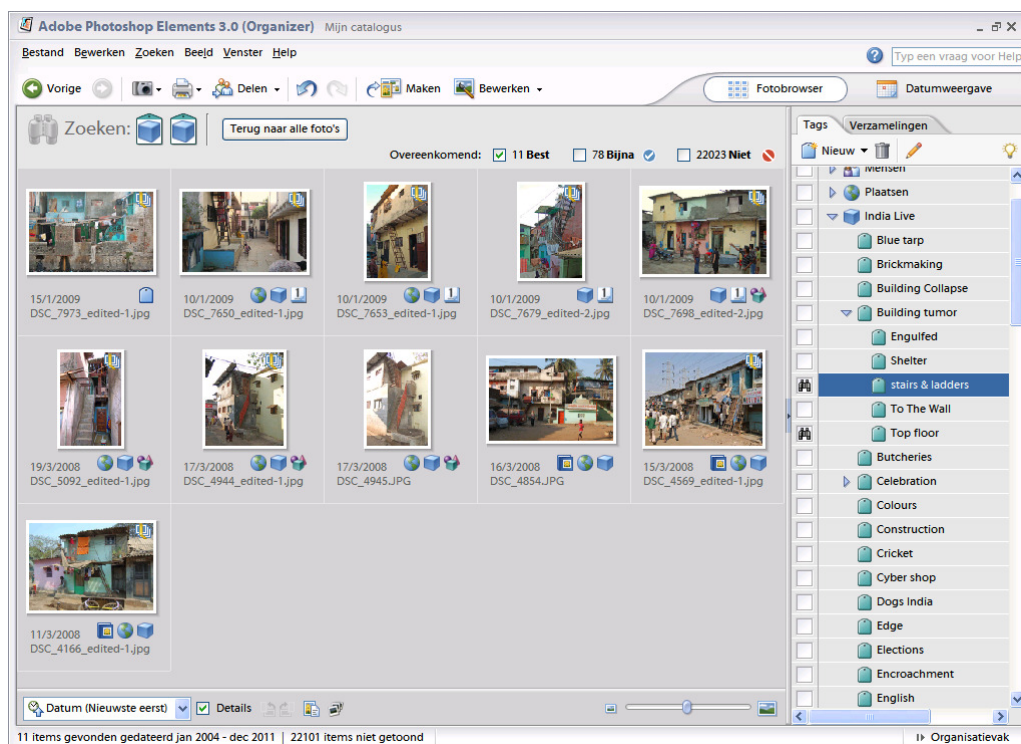
Image 1. Screenshot of Adobe Photoshop Elements. Its Organizer function is a coding tool. A list of tags, displayed on the right, affords coding and retrieval.

Data reduction was done by coding in a process Graham Gibbs described as "In the visual arts the term 'intensive seeing' is used to refer to the way that we can pay close attention to all the things we can see, even the commonplace and ordinary." (G. R. Gibbs, 2007). Photos were studied in detail and coded for elements relevant for further

study. In brief, photos were coded with intuitively created tags, based on items or events, patterns, and phenomena in the photo. The use of tags and combinations of tags affords diversity in access to data.

Image 2. Screenshot of The Perfect Slum blog.

Data display (as analysis tool) was done by writing narratives about phenomena and patterns found in photos sharing the same codes. The narratives were published as a blog titled THE PERFECT SLUM (de Maat, n.d.).

Research Issues Learned from the Pilot Study

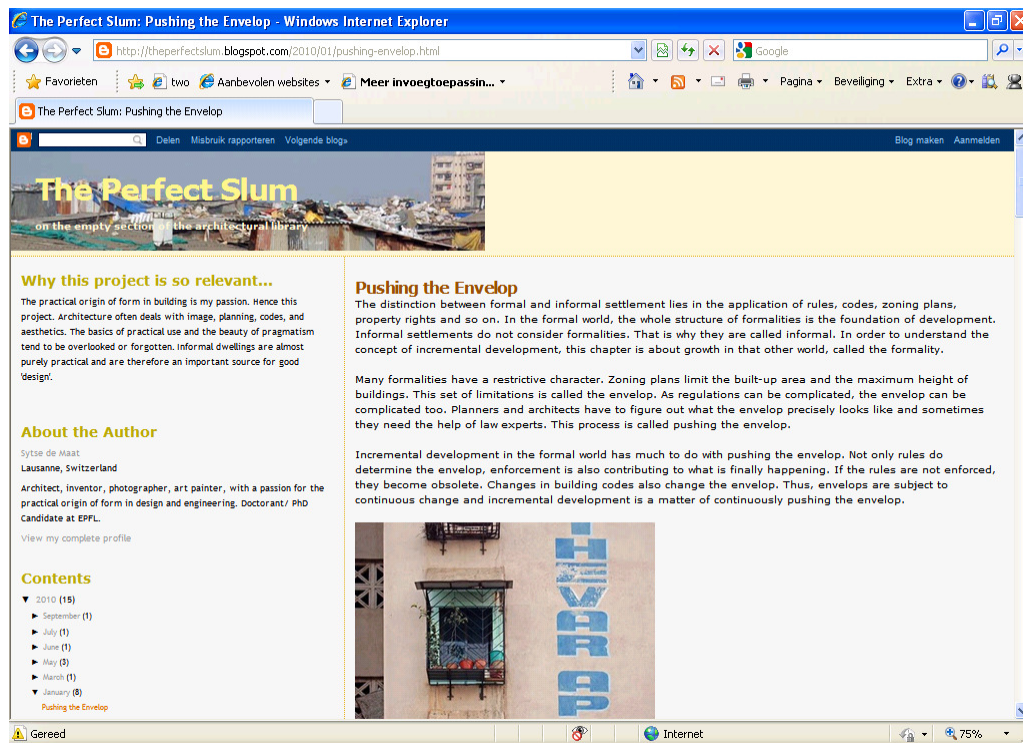The need to improvise in fieldwork was evident. Especially when working in an unfamiliar culture in a country with a high degree of informality, it is essential to work in a way that goes with the flow. Many of the recommendations mentioned in "Fieldwork strategies and observation methods" (Patton, 1990) were recognizable.

The importance of meticulously making field notes was underestimated. As a result, the findings were hard to support with reliable data. This showed mainly in the phase of evaluation.

The way of working was intuitive and was only in hindsight described in terms of data collection, data reduction, data display. In a later course on qualitative research methods, the structure of Diagram 6 linked the experience of practice with the presented methods. Moreover, Diagram 6 shows that the lack of a clear problem statement will affect data collection. As one of the aims of the pilot study was to find a topic for the doctoral research, it is hardly surprising that the lack of the problem

statement (and with it a framework) was clearly felt, which illustrates that 'nothing is as practical as a good theory'.
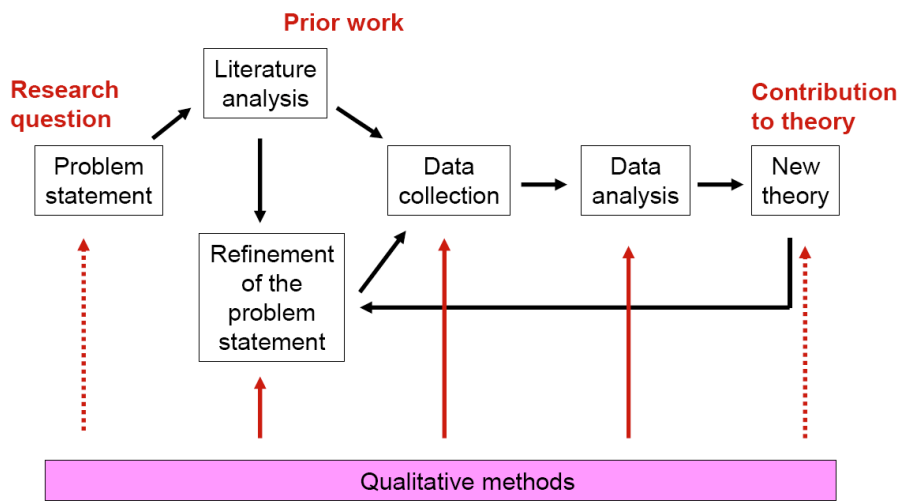
Diagram 6. Steps in research methodology, recognized in the pilot study in hindsight. Source: Syllabus of PhD-course Qualitative Research Methodology (Finger, 2011).

Notwithstanding the above, the pilot study fieldwork also illustrated the interactive nature of steps in research. The steps shown in Diagram 6 are not all linear in their order, as expressed in Diagram 7.
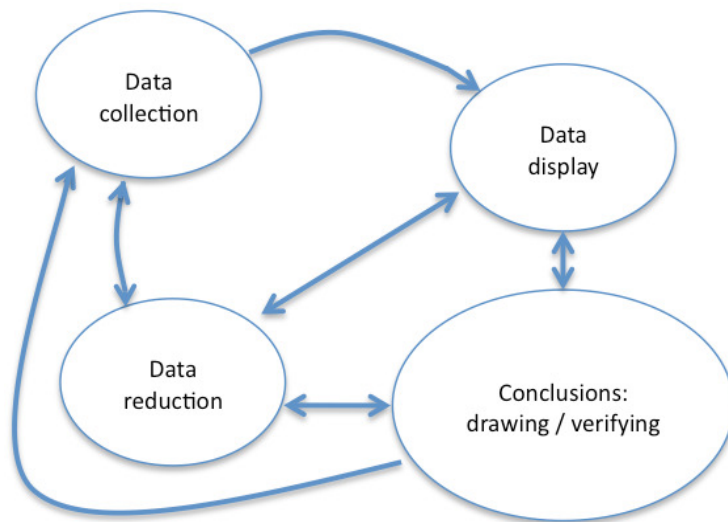
Diagram 7. Components of data analysis: interactive model (Miles & Huberman, 1994).

Organizing the data revealed the need to create hierarchies and to move from descriptive coding to conceptual and meaning (Miles & Huberman, 1994), as explained in Treatment of the Data on page 95.

Summary of the Pilot Study

Since the pilot study was conducted before the doctorate, the lack of research methods and skills became apparent and thus contributed to the effectiveness of the courses taken later. Moreover, this lack of tools and skills was an encouragement to find new tactics like 'Take and Give' and the use of photo organizer software as a coding tool.

In addition, the pilot study afforded learning about the practicalities of doing research in India and thus paved the way for planning fieldwork in a region where planning as we are used to in Switzerland, does not work. The acquired familiarity with the terrain and the increased awareness of opportunities and threats contributed to a feasible research plan, which is after all the purpose of pilot studies.

Research Methods Epilogue

Research for grounded theory is much like exploring uncharted terrain. Since there is no map, one does not know what to expect and therefore cannot plan his methods in detail. At best, there are maps of some adjacent areas, but the aim of the research of course is to fill that blank part of the map. To do so, one has to enter the unknown and engage with unexpected phenomena. The next challenge lies in building a consistent image from initially incoherent findings.

"If we knew what it was we were doing, it would not be called research, would it?"

Albert Einstein

In a research like this, the researcher has to navigate several dialectics. One of them is positivism versus relativism (see page 26). Architecture research is particularly torn between these two poles since its technical side is suitable for positivism, whereas its artistic side requires a more relativist vision. Research on 'people and building' inevitably has branches in both directions, and bears the risk of getting lost in the vastness of cognate areas. Saskia Sassen's 'Before Method' provides a strong anchor in the infinity that relativism affords. Placing oneself firmly *vis-à-vis* a topic is identical to formulating an adequate research question. This rigorous focus on the blank spot on the map proved particularly helpful in the 'guided conversation'-style interviews. A sharp and clear research question is a reliable compass.

A second dialectic is about topic and method, of which, according to Sassen, the latter follows from the first. It is essential that despite the advantage of an open and intuitive approach towards the topic, the research eventually aims at rationalization. For this, one has to link his way of working with accepted methodology. Relativism can thus benefit from positivism.

Thorough research requires rigorousness. Method is a way to guard this rigorousness but can also turn against it. Rigid application of a method leaves little room for serendipity and thus limits the yield of the research. Rigidity therefore, is a pitfall on the path of rigorousness. Again, focusing on the research question is the way out here. In the research for this thesis, Take and Give, Sketching Together, and Scale Models were identified as viable research methods because their side effects resonated with the core research question. Besides having a clear relation with the research question, the methods developed in this research were also linked with known qualitative methodology. An example is the use of tagging tools available in Photoshop Elements organizer and Zotero reference manager, for coding. Thus, the methods developed in this research were built to fit the data as it occurred in the field, yet to allow analysis with existing qualitative research methods.

Back to the dialectic of positivism and relativism, the chapter Results of the Case Studies on Vernacular and Transitional shows both sides, as it is organized along themes that describe the symbiosis of people and building. A strictly positivist

approach would result in a categorization by 'static' architectural items (roof, kitchen, etc.) or 'kinetic' human aspects (wedding, slum or informal). The themes though, are not predefined categories but constructs that emerged from the findings. Only a blend of static, kinetic, positivist, and relativist can adequately respond to the research question about the symbiosis of people and building.

Results of the Case Studies on Vernacular and Transitional

Introduction

The research in India took place mainly in Mumbai's Dharavi. Although many pockets of informal settlement exist in Mumbai, Dharavi was the place of first choice since it is by far the largest continuous area of its kind. Smaller pockets are more interwoven with the planned city, whereas Dharavi with its over 750.000 inhabitants is a city on itself. Places that star in the below thematic descriptions are indicated in Map 1.
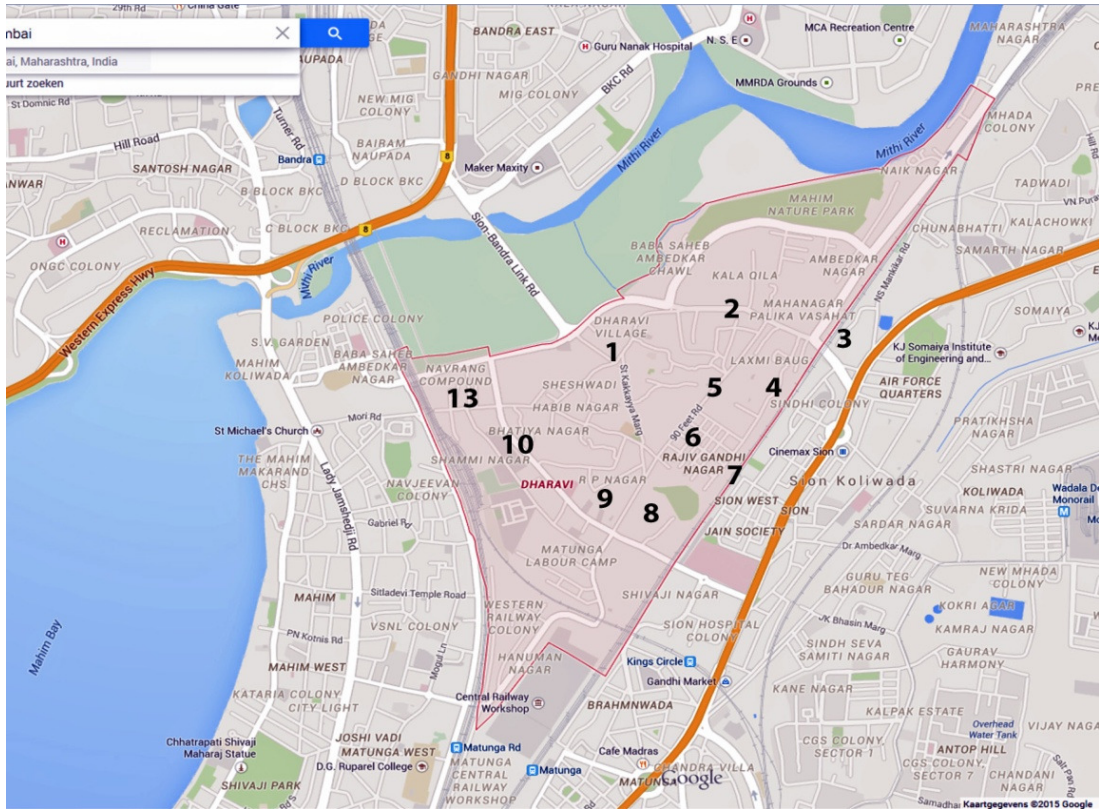
Map 1. Dharavi as on Google Maps (image by Google, numbers added SdM), showing:
1. Koliwada
2. Station Road
3. Sion Station
4. Mahatma Gandhi Road
5. 90 Feet Road
6. Transit Camp a.k.a. Rajiv Gandhi Nagar
7. Dhobi Ghat
8. Kumbharwada
9. Kuttiwadi
10. 60 Feet Road
13. Navrang Compound a.k.a. 13th Compound

Map 2 shows the other places in and around Mumbai that play a role in the case studies. Vernacular cases are Manor, Kelthan, Pundhe, and Tara. Transitional are Dharavi, Worli, Versova, and Vasind. Modern are Navi Mumbai and Panvel. Map 3 shows Bihar, bordering Nepal and Bangladesh, and far from westernized Mumbai.

Map 2. Places in and around Mumbai, mentioned in the research.
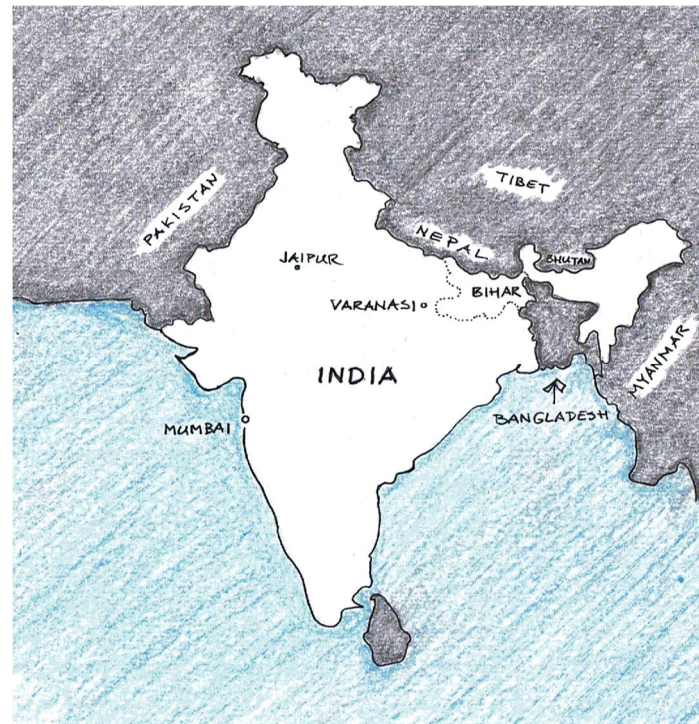
Map 3. Seen from Mumbai, Bihar is a remote area.

Besides answering the research questions in the framework of this doctoral thesis, the following chapters also seek to describe what 'slum' is, how it works, and why it looks like it does. Dharavi had received already much attention, but the release in 2009 of Danny Boyle's movie **SLUMDOG MILLIONAIRE** definitely fuelled the interest for this urban phenomenon. Most of the studies on Dharavi so far are part of action research, i.e. conducted in order to recommend changes. The research of this thesis is not aiming at interventions. Instead, the following chapters describe what happens when people move from a life in vernacular environments to life in the modern city.

Kacca and *Pucca*

In order to understand the architecture of urban informal settlement, its origins were searched using 'follow the people' as a compass. It is based on the logic that it is people who create buildings and that when people migrate; their way of building migrates with them. This chapter starts with a look at where informal settlers come from and what architecture one finds there.

Migrants to the city generally come from the countryside, towns, and villages. In the case of India, the migration chain can be described roughly as *Tribal – Rural – Urban*. In this thesis, *Tribal* designates those people who live in a close relationship with the forest, in pockets of only a few houses. *Rural* covers small villages based on agriculture, whereas towns and cities are *urban*.

What We See …

An important marker of the differences in way of life of tribal people as compared to urbanites, is the balance of indoor and outdoor activities. When much space is available around the house, as is the case in tribal settings, many of the daily activities take place outside. Therefore, there is limited need for indoor space. The house is mainly a place to keep things safe, whereas home activities stretch out around the house. The land around it is part of the realm of the home. The veranda is an item that expresses this hybrid notion of inside and outside very clearly. It is a sheltered outside and still part of the home. In a modern urban setting, the home is confined to the house. The near absence of windows in tribal architecture is another indicator of this outdoor oriented lifestyle. During the day, doors on both sides of the house afford cross ventilation. A small window is enough to allow daylight where needed, and often such a window is constructed in the roof. Windows in a wall would be a weakening of the protective function of that wall.

An often-used distinction in building techniques is that of *kacca* and *pucca*. *Kacca* involves earth and organic material, unlike *pucca*, which is more about durable materials like brick, stone, timber, and cement. This distinction will be elaborated below, since it is more sophisticated than a mere material difference. *Pucca* is understood as 'solid' and 'permanent', and comes from the Hindi word पक्का *pakkā*, which according to various Hindi-English dictionaries means 'cooked, ripe, solid, complete, inerasable, thoroughgoing, …' It is the opposite of कच्चा *kaccā* (also: *kutcha*) 'raw, unripe, crude, uncooked, unmade, careless, superficial, …' Note that these meanings are related to both the material and the process. Khosla (1983) says about *pucca* that it "refers to the use of fired materials for the walls, like bricks or blocks; it also assumes [...] a concrete or firm tile roof and all the ancillary specifications such as

good flooring, doors and windows. *Kutcha* conversely [...] implies mud walls, a temporary roof of thatch or country tiles."

... and How It Works

The logic of countryside architecture is to use locally available materials. From today's perspective, this may seem primitive and due to a lack of means of transportation, but that is obviously reasoning with hindsight. The absence of cheap transportation is the default situation; its availability is the exception. Moreover, it is simply irrational to put effort in transporting materials over long distances when adequate materials are at hand. In addition, every built structure needs maintenance and renovation, which is again easier without the logistics that come with the use of exotic materials.

Local materials available to tribal people in the regions around Mumbai, are those that come from the forest: wood, twigs, leaves, earth; from riverbeds: reed, clay, mud, stones; and from livestock: cow dung, urine, hides, and hair. A typical *kacca* house is built on a base of earth contained in a low stonewall. A wooden structure of poles and beams bears the thatched roof. Walls are filled in with matting of leaves or wicker, and then plastered with layers of mud and cow dung. This plasterwork is essential in keeping snakes, insects, and rodents out. Cow dung is sticky and has a binding effect, but easily damaged by termites. Mud is termite resistant, but brittle. The combination of these characteristics through the application of alternating layers of cow dung and mud, results in a sturdy termite resistant plasterwork. The cow dung's cellulose binds the sand grains, while the sand protects the cow dung from termites that typically have no appetite for mud. With the same technique, one can seal earth floors, using cow dung dissolved in water and then used to wash the earth floor. Washing floors this way approximately every week, is a routine that repairs cracks, binds dirt, and makes the floor more solid over time. The result is a smooth dirt free floor, easy to sweep and pleasant to the feet. Its ability to 'breath' contributes to quality of the interior climate. Clearly, this technique requires frequent maintenance and consequently the house demands time from its occupants.

A *pucca* house is built of more permanent materials, like bricks and roof tiles. Another distinction with *kacca* lies in the way materials are produced and acquired. Roughly one could say *kacca* materials are directly available from nature (or the environment at hand), whereas *pucca* first need processing like firing in a kiln.

Note that *kacca* and *pucca* are comparative qualities, i.e. a material can be qualified as more *pucca* in comparison to another material. The same goes for structures. An improvised dwelling is *kacca* compared to permanent settlement. In addition, *pucca* can be the result of applying a certain technique, without changing the material. A house built by professionals is likely more *pucca* than a DIY-one, which is also the *porté* of what a beneficiary said about a certain house improvement scheme: "if the government is giving me a house then why doesn't it give me *pucca* house? – a *kutcha*

house I can build myself without their help" (Khosla, 1983). In building improvement, the tendency is to move from *kacca* to *pucca*. In this thesis, the term *puccafication* refers to turning a *kacca* structure into a more permanent one.

The permanency of *pucca* materials and techniques inevitably makes it less easy to adjust the house to the needs and habits of the occupants. Through *pucca*fication, the relationship between house and occupants becomes more rigid, more fixed. A *kacca* house is easy to change, and in fact, the occupant is in charge of how he and the house go together. In a *pucca* house, the structure is less flexible and the occupant will have to adapt to it. Of course, people create a balance that suits them best. The following paragraphs will show examples of balancing *kacca* and *pucca* for maximum flexibility.

Photo 22. Base and beginning of a wooden structure for a *kacca* house. All materials come from the site's immediate vicinity. A dry wall, i.e. without mortar or cement, surrounds the base. Tara, February 18, 2010.

A typical *kacca* house is built of a wooden structure with an infill of earth walls or wooden matting covered with earth and cow dung plaster. For *puccafication*, brickwork could simply replace both the load-bearing structure and the infill. Brickwork has load-bearing capability, so a distinction between structure and infill is not necessary. For flexibility however, that distinction is very useful and the logical thing to do is to make the structure *pucca* while keeping the infill more *kacca*. Using the same bricks, masonry becomes *kacca* or a *pucca* by respectively using earth and cement for mortar. With that, columns are made of brickwork with cement mortar replace the wooden structure, whereas the infill is made with earth mortar. This affords future changes and saves costs of cement.

Photo 23. A combination of *kacca* and *pucca*. The walls of matting plastered with earth and cow dung are *kacca*, whereas the roof tiles and cemented base are *pucca*. Tara, February 21, 2010.

Photo 24. The use of cement mortar in this corner column is a handshake of pucca and kacca. The wall is made of earth mortar masonry and affords easy future changes while keeping the main structure. The dentations on the left are a provision for future extension. Near Vasind, February 27, 2010.

Photo 25. Earth mortar affords easy changing of a facade, as is visible from the traces of the former doorway on the right. Near Vasind, February 27, 2010.

Photo 26. It is easy to create a ventilation grill in a *kacca* wall. Kelthan, January 18, 2013.

Replacing of building elements in the gradual process of *pucca*fication shows a certain order, understandable from the perspective of rainwater management. The roof is the most basic protection against rain. Therefore, the introduction of *pucca* starts with roof tiles replacing thatch and leaves, as in Photo 28. Second, the raised level of the floor provides protection against flooding. The next *pucca* step is to mason the stones of the base's dry wall with cement mortar, as seen in Photo 23. The introduction of bricks is a

third step, followed by the use of cement for mortar (Photo 24) and later for plasterwork (Photo 27).

Photo 27. *Kacca* **extension of a** *pucca* **house: earth mortar versus cement plaster. Pundhe, November 8, 2012.**

Photo 28. A house built of the materials that surround it. The only *pucca* **are the ceramic roof tiles. The rice thatch on top provides extra protection against the sun. Near Kelthan, January 18, 2013.**

Brick Making

Brick making is an activity that can be done by the household, but like with the production of rice, surplus can be sold on the market. Nowadays, although it is still handwork, bricks are produced in an industrial manner. In the countryside, it is often part of the local economy, especially in environments with clay rich soil. Such clay is found in riverbeds that are accessible during the dry season. The clay is mixed with water at night, and molded latest before sunrise, since otherwise the hot sun dries the clay and makes it unmanageable. Green bricks are left to dry for four days. Then the green bricks (fired bricks are red) are stacked with thin layers of sawdust and coal between them, resulting in a stack that is a kiln at the same time. Stacking and fueling is a precise job and requires the presence of experts. Fuel must be applied evenly and balanced since once lit it is impossible to make adjustments. The dense packing of the kiln keeps the heat in and thus generates high temperatures, yet allows sufficient airflow for the burning.

The firing itself takes about fifteen days. Then the stack can be unpacked and the quality of the bricks assessed. Bricks at the core have received the most heat and are therefore of the best quality. The bricks on the outside are of the least quality and often not suitable for use in construction. In order to reduce this gradient in quality, the outer skin of the kiln is a separate structure, much like a cavity wall. This way the stack is insulated. Since the heat stays inside, it will spread more evenly and contribute to a more constant quality. Bricks of too poor quality remain on the spot and serve again in the skin of the next kiln.

Photo 29. Brick making starts with molding clay-rich soil and drying the raw bricks for four days. Near Manor, January 5, 2013.

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Photo 30. Clay-rich soil is typically found in riverbeds, which are only accessible during the dry season. Therefore, brick maker's houses are temporary and *kacca*. Near Manor, January 5, 2013.

Bricks of sufficient quality find use for building throughout the region, including the city of Mumbai. Note that transportation is only required after completion of the product. All phases of the production process take place on the same spot. Nature provides all raw materials on site, except the small amount of coal bought from other places.

Photo 31. Building a new kiln stack. The firing process changes the color of the bricks from green to red. Insufficiently fired bricks are reused in the skin of kiln. Near Vasind, February 10, 2010.

Brick making is a dry-season activity, as it requires access to the riverbed and the drying of green bricks. Consequently, it alternates with rice cropping, which is a typical monsoon activity, and it is common practice in families to work in both farming and brick making. In addition to this pattern, the same brick makers work as construction workers in the city during monsoon.

Photo 32. Rebuilding *pucca*. Cement is a marker of *pucca*fication. Kelthan, January 18, 2013.

Photo 33. This makeshift house is profoundly *kacca* as it is made of readily available *kacca* demolition waste. Kelthan, January 18, 2013.

Brick making being part of the local economy brings *pucca*fication to tribal people's doorstep. Government supported improvement schemes help people to replace *kacca* walls with masonry. In practice, this means that people dismantle their house and rebuild it with bricks and cement. Since it is not possible to rebuild a house overnight, the occupants stay temporarily with neighbors or family.

What It Tells Us

We already saw that the distinction between *kacca* and *pucca* is a relative one, i.e. when comparing two materials, structures, or techniques. A house built of masonry is more *pucca* than a straw bale house, whereas compared to concrete masonry is more *kacca*. So far, the focus was mainly on physical properties, but as already mentioned, the way of acquiring, processing, and producing materials is a distinguishing factor too. As suggested by Caimi & Hofmann (2005), techniques as such can make structures more *pucca*, for example by weaving materials or designing roofs with a larger overhang. Many building characteristics fit in the dialectic of *kacca* and *pucca*, as collected in Table 5.

Kacca	*Pucca*
Ephemeral	Permanent
Occupant makes adjustments to building	Occupant has to adapt to building
Durability depends on skills	Durability comes from material
High maintenance	Low maintenance
Do It Yourself	Outsourced
Everyday	Specialized
Crude	Craftsmanship
Pragmatic	Systemized
Vernacular	Market
Custom-made	Ready-made
Readily available materials	Processed materials
Low impact on environment	High impact on environment

Table 5. Building characteristics categorized in a *kacca - pucca* dialectic.

*Pucca*fication also relates to changes of lifestyle. Mrs. Patil for example, used to live in one of the last remaining *kacca* houses in her village (Photo 34). Although she appreciates the fine qualities of the *kacca* architecture, her job as a teacher does not leave her sufficient time to do the necessary maintenance on the house. She explained that the modern lifestyle based on the nuclear family[10] instead of the joint family[11], is only affordable when one earns enough money, i.e. when one has a job outside the home. The necessary frequent washing of cow dung floors and earth walls is simply too

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[10] A nuclear family consists typically of a couple and their children.

[11] The joint family includes grandparents, aunts and uncles.

time consuming. Moreover, the income she generated with her job as a teacher, allowed Mrs. Patil to have her house converted into a *pucca* one. The interview with her took place two weeks before the house was demolished, and rebuilt *pucca*. She expected important changes in her relationship with the house as her home, since she had already noticed such changes when she changed her source of income. For example, before taking a full job as a teacher, farming was the main livelihood. From the day Mrs. Patil sold the 30 cows part of the household, all kind of problems started to occur, one of them mosquitoes feeling free to come in. The scent of cow urine is a natural mosquito repellant, and the departure of the cows afforded the arrival of potentially infectious insects in the home. In the tropics, of course this is a big thing. The absence of cows also deprived the household of its source of cow dung and thus directly undermined maintenance of the house. Not only had modernization made Mrs. Patil change her household, it also brought her the need to take artificial measures against diseases. Mrs. Patil foresaw more of such changes, but felt compelled to have her house rebuilt *pucca*, since "everybody in the village does so and living in an old fashioned house will not be good for my reputation as a school teacher".

Photo 34. Mrs. Patil's *kacca* house two weeks before replacement with a brickwork-and-cement version. The neighbors already changed to *pucca*. Kelthan, January 18, 2013.

Photo 35. Mrs. Patil's *kacca* house, kitchen area. January 18, 2013.

The story of Mrs. Patil shows how people and buildings become independent from each other in modernization. In a *kacca* house, everyday life activities are closely related with the house and the house cannot survive without the frequent support of the human hand. In *pucca,* the house becomes less dependent on the occupant vice versa, i.e. the two get disconnected.

Photo 36. *Pucca* house in the same village, showing extensive use of cement. Kelthan, January 18, 2013.

A step further in the direction of *pucca* is that from a ground bound dwelling to a multistory condominium. Mr. Korde in Sion Mumbai used to live with his mother,

three brothers, and three sisters in a small two-room *chawl* until it was sold for redevelopment. Part of the arrangement was a free of costs condominium for Mr. Korde on the fifth floor in the new to build concrete eight-story high-rise. He now lives there with his wife and his daughter. As Mr. Korde gently put it: moving from the *chawl* to the condominium was 'upsetting'. He could not sleep for six months. He felt it was 'not his house' and missed the social environment of the *chawl*. Note that Mr. Korde's change of house type coincides with the change from joint to nuclear family. Besides the social and psychological aspects, he argued that concrete is a problematic material for many reasons: the concrete becomes much too hot to be comfortable, it has poor tactile qualities, and it comes with an inherent impossibility to change the layout of rooms or make even the smallest hole in a wall. Concrete is too *pucca* for changes. People are forced to adapting to the building, instead of improving it.

What Mr. Korde appreciated most in his former (more *kacca*) chawl was the cow dung floor. Mr. Santosh Nichite in Pundhe also lauds the qualities of cow dung floors. The house he lives in together with his joint family has gradually become more *pucca*. Since a bed in India is mostly a thin mat on the floor, the difference between cow dung and tiles on concrete is felt clearly. A cow dung floor has more moderating capacity, i.e. it maintains constant temperature and humidity. According to Mr. Nichite, floor tiles give more health troubles and for that reason, the family decided not to put tiles in the kitchen.

Photo 37. Mr. Mathre in Tara village is maintaining the floor around the house by washing it with a mix of water and cow dung. Tara, February 19, 2010.

Photo 38. Road workers temporary housing built of corrugated tin sheets. Alibag, January 13, 2010.

Since construction typically creates temporary employment, construction sites are an inevitable pull factor for improvised housing. Because of their temporary character, construction site dwellings are built of relatively *kacca* materials and techniques. Their architecture has much in common with pavement dwellings and slums (Photo 38). A distinctive difference however is the use of metal corrugated sheets. Such sheets are a 'readily available material' since contractors use them to fence off construction sites. Moreover, metal sheets are cheaper than the asbestos cement sheets typical of permanent informal settlement.

Pucca is not necessarily better than *kacca,* as the above has already shown. There are people who move back to *kacca*, like Mr. Vadu for example. He lives in a house with *kacca* walls now, next to his former more *pucca* house. The *kacca* house however has a roof of corrugated fiber cement panels, so maintenance only requires a yearly round of plastering the walls. The *pucca* house with its masonry cement-plastered walls is abandoned (Photo 39). The cemented walls and floors had an unpleasant effect on the interior climate and were difficult and expensive to maintain. Mr. Vadu is an artist and expert in Warli-painting. Warli painting and its relation with architecture will be discussed later. Mr. Vadu prefers the *kacca* house because it fits better with the artwork and his profession. In order to give maximum protection against wind and animals e.g. tigers, the *kacca* house has no windows. Doors on both sides of the house afford cross-ventilation (Photo 40).

Photo 39. Mr. Vadu and his family abandoned their *pucca* house on the left. They prefer living in their new more *kacca* house on the right. January 5, 2013.

Photo 40. Mr. Vadu's house is deliberately equipped with *kacca* walls. In order to create maximum protection against animals, there are no windows. January 5, 2013.

Dr. Deelip Kadam of Dhawale Hospital in Manor, argues that concrete is a problem for human health.[16] According Ayurveda, a traditional system of Hindu medicine, body temperature and the temperature of a building must follow each other. Concrete however fluctuates too much. The cement industry therefore is the real problem, since

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[16] In interview with SdM on January 5, 2012.

it promotes the use of unhealthy materials. Conspicuous consumption[17] is a motive for people to move or change to concrete housing.

The above illustrates that the *kacca–pucca* distinction is a relative one and that it applies to both material and construction. Combinations of *kacca* and *pucca* are common. The preference for more *kacca* or more *pucca* has practical reasons, e.g. comfort and maintenance; social reasons, e.g. status; or psychological reasons, e.g. well-being.

This preference for *pucca* is so strong that building strategies aiming at the use of *kacca* are exceptional. In **ARCHITECTURE FOR THE POOR**, Hassan Fathy (1973) explains how the introduction of modern architecture in Egypt as a way to deal with housing shortage, went slow since steel, glass, and concrete were costly. The Second World War worsened that situation, whereas mud, the traditional *kacca* building material, was available in abundance. Fathy therefore sought new applications of indigenous architecture and thus modernized *kacca* construction of affordable housing.

*Pucca*fication in tribal regions has raised concerns among experts as it might lead to loss of culture and create environmental issues. In government, supported schemes to improve tribal housing and help people create *pucca* houses; restrictions on the use of cement are an important tool to curb such effects.

Photo 41. The use of color paint is a marker of permanency and consolidation. It shows *pucca*. Near Vasind, February 27, 2010.

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[17] Conspicuous consumption is explained by Thorstein Veblen (1899) as showing off with one's consumption pattern in order to emphasize belonging to a wealthier class.

The *Pucca* Nature of Urbanization

Painting 1. People performing a several days cleaning and blessing ceremony for their villages. The landscape is open; the lines represent paths and connections. Painting by Vadu Madhukar 2012.

Painting 2. In the urban landscape, life is confined to pots, frames, and boxes. Mural in Mahim Nature Park, Mumbai. Artist unknown. July 25, 2014.

*Pucca*fication also has parallels with urbanization. Settlements in the jungle and hamlets in the rice paddies are *kacca* as a whole, whereas the city with its high-rise and paved roads is more *pucca*. Besides that, the degree of formal order is what makes the city even more *pucca*. This notion is visible in the following Warli style paintings, where openness and soft transitions mark the tribal landscape in Painting 1, whereas in the city in Painting 2, boundaries are hard and most items sit inside some form of framework.

Formality, the Virtual *Pucca*

So far, *pucca* is a material quality of an object compared to another object. In essence, *pucca* is about permanence. In the context of a community however, permanence also depends on acceptance by others. If in a hamlet someone wants to build an extension to his home while the community does not agree with it, the new structure will enjoy little permanence. Rejection or acceptance by the local community therefore makes a building more *kacca* respectively more *pucca*.

When despite the disagreement the extension is built, it may happen that others eventually accept it, perhaps in exchange for some favors. It all happens in a continuous process of negotiation, which goes on even after completion. In the context of the city, building application procedures formalize this process of negotiation, and finish it with a building permit. From there, the debate will stop and secure permanency. Thus, permanency in the city is supported by a formal system that is in favor of hard guarantees, whereas permanency in the convivial community is softer. In parallel with the *kacca - pucca* dialectic, a house in a convivial context is more *kacca* compared to the formalized situation, where it is more *pucca*.

Again, this *pucca*fication does not automatically mean an improvement to the house. For example when residents would like to change something to their house, they will have to go through all kind of procedures even when all stakeholders support their idea. The slow motion of regulations hinders improvements.

In informal settlement in particular, the legality of a given situation is a major factor in the quality (i.e. value) of a building. A crappy slum dwelling, of which the owner has title to the land, is more permanent than a rock solid structure built by a squatter on a municipal garbage dump. Land grabbers who buy land titles from ignorant slum dwellers, know this distinction well. Although material and legal *pucca* are not exchangeable, some believe they are, as illustrated in BEHIND THE BEAUTIFUL FOREVERS. When asked what sense it makes to invest all savings in making a hut more *pucca* although their whole garbage dump squatter settlement is slated for demolition, many an occupant's logic dictates that "for sure the authorities will be more willing to provide us with permanent housing" (Boo, 2012).

Summary

In the process of *pucca*fication, tougher, more durable materials reduce the maintenance of the building and increase its permanence. The application of such materials requires certain tools and skills and thus becomes more and more the domain of experts. Since occupants themselves can do *kacca* construction while *pucca* requires the expertise of others, *kacca* is typically vernacular, whereas *pucca* is characteristic of modern. The same pattern occurs with the introduction of formality and legal systems. *Pucca*fication therefore, marks the transition from vernacular to modern living.

In the next chapters, we will see that skills and way of life go with the people. In the chapter about Pavement Dwelling for example, we will see the *kacca–pucca* distinction again, with the same people but with different locally available materials, and in a different sociologic context. An example is the *pucca*fication of the roof, which led to the introduction of the roof terrace and a relocation of social interactions, as will be discussed in the chapters about Street (page 164) and Roof (page 189).

Pavement Dwelling

Photo 42. A tent set up for pavement dwelling in Matunga, Mumbai. August 6, 2014.

The story of informal settlement in cities begins with pavement dwellings. These dwellings are of the most basic character and sit, as the name says, on the pavement (=sidewalk in US-English). They look improvised, just as if someone knocked together a shelter of whatever was at hand. Being many people's first step of the journey to settling in the city, pavement dwellings are emblematic of informal settlement in the dense urban world. This chapter will discuss the architecture and the way of living that are typical of pavement dwelling. It will show how both relate to the vernacular home villages of the migrant dwellers.

Pavement dwelling mostly starts with newcomers to the city. They come from the countryside and try their luck, find some work, or sell the products from their family's farm. Indeed many pavement dwellers have family outside the city, and the first trips to the city can have the character of commuting. Although the railways in Mumbai afford this commuting, the trains are extremely crowded and many people have no other option than to spend the night in the city. Sheltered places however are scarce and, weather permitting, people sleep under the open sky, in the street, on the pavement. Sleeping in the open air is not uncommon in Mumbai, and especially sleeping on rooftops is popular. It is an easy way to escape the heat trapped in the building and to find some privacy from the shared rooms inside. Moreover, rooftops are the first places that cool down after sunset and thus provide comfortable sleeping conditions. Rooftops of course are less secure than lockable houses and bedrooms. Still, many prefer the pleasant climate under the sky.

Photo 43. Near Dockyard road, Mazagaon, Mumbai. Single-story *kacca* pavement dwelling, built with materials readily available in the city. January 9, 2010.

The security issue however is exactly what makes sleeping on the pavement so unpleasant. One has no protection against whatever disturbance, and proper night rest is hard to get. Being exposed to (traffic) noise all night is already detrimental to both physical and mental health (Muzet, 2007; Pirrera, De Valck, & Cluydts, 2010). When with a group, it is possible to have one keep guard while others sleep, but disturbances come from more than bad intended people alone. Insects, rodents, and noise are permanent nuisances too. People catch rat bites in their face while asleep (Boo, 2012). Having to sleep without shelter night after night, is stressful, exhausting, and eventually a threat to survival. From the perspective of symbiosis, it is of critical importance for man to be with shelter while asleep.

Once the newcomer's life in the city becomes steadier, and other family members come over, they definitely need a personal shelter. For many, the only option then is to knock together a shelter on the side of the road, in other words to create a pavement dwelling. This is how informal settlement begins; it is how a new dwelling is born, and how symbiosis starts. Although some pavement dwellers are newcomers, they are not the transient population of migrants often believed to be. A survey (SPARC, 1985) carried out in Byculla and Mazgaon shows that their stay is permanent and a vital factor in Mumbai's economy (Hollick, 2011). Most of the dwellers had lived on the same spot for years, often decades. The popular label 'here today and gone tomorrow' is based on a myth, and actually pavement dwellers do not move unless they are forced to. This permanency is visible in the architecture of the dwellings, as will be explained below (page 132). The same survey also showed that virtually none of the dwellers were beggars. They are self-supporting with about half of the population working and supporting the other half.

Photo 44. Pavement dwellings in Byculla, Mumbai. April 17, 2013.

The SPARC survey also showed that most pavement dwellers (67%) gave as reason for their migration acute poverty, landlessness, and lack of employment; 52.4 % had owned no assets whatsoever, and 27.2% had owned only a hut. Once in Mumbai however they cannot make enough money to afford proper housing, not even a slum dwelling. Thus, they end up trapped in a life of pavement dwelling. Consequently, pavement dwelling is a persistent phenomenon. All pavement dwellers initially see their situation as temporary and intend to move to better housing.

The main pull factor for informal settlement is the employment found in the city. More than 60% of the working population of pavement dwellers has their work within walking distance from their dwelling, i.e. taking 30 minutes or less. If work that consists of walking (porters, handcart pliers, etcetera) is included, one finds that 85% of pavement dwellers do not use (public) transport for work (SPARC, 1985).

The purpose of a shelter of course is to protect its occupants against influences from outside. These influences include animals like insects, snakes, rodents, monkeys, and in rural settings also tigers. A second purpose is to protect the occupant's belongings from thieves and predators. In the countryside, cattle often stay inside at night. In a way, a house serves as a vault while much of living activities takes place outside. The presence of a steel filing cabinet in most households, even in dwellings that are devoid of other furniture, embodies this purpose of keeping belongings safe.

Photo 45. *Kacca* pavement dwellings on a bridge over Reay Road, Mumbai. The use is mainly residential, accommodating employees of the neighboring ship repair area. The ladders reveal the presence of lofts. January 9, 2010.

The architecture of pavement dwellings has a simple and obvious logic: it is a mix of countryside techniques and urban materials. The previous chapter described the architecture of traditional countryside dwellings. This chapter will show how it is recognizable in urban pavement dwellings.

Skills are a human trade and inevitably move with the person having them. For that reason, the way migrants build relates to their vernacular origin. Therefore, the main differences between the architecture of a pavement dwelling and a vernacular dwelling lie in the materials, which are very different indeed. As already mentioned, the logic of countryside architecture is to use locally available materials. Taking that logic to the city, the 'locally available' is of an essentially different character. In a vernacular setting, most materials come from any place but the market. They come from nature or are the product of the household. In urban settings, most building materials are only available through commercial channels. Cheap materials are those that come from mass production, and the cheapest are those that have gone through the commercial cycle several times, i.e. are recycled, or even considered waste. Uniformity marks such mass produced materials. They come in standardized dimensions fit to systems based on repetition. This is an essential difference with vernacular materials, which do not require uniformity since they do not go through a supply-based market and need working in order to fit together. What we see in the architecture of pavement dwellings therefore, is the use of materials in a vernacular way, although intended for use in repetition-based systems.

Photo 46. Sheets of corrugated steel used here in a non-repetitive and non-systemic way. January 15, 2009.

In addition, mass produced materials often require relatively sophisticated tools for making them fit in an off-standard situation. The absence of such tools is visible in the apparent sloppiness of the pavement dwelling. From an industrialized perspective the dwelling looks messy as materials look 'damaged' (although they are only worked to fit), whereas from a vernacular perspective, it is the material that is unforgiving and causing the problems.

From the perspective of symbiosis, the pavement dweller faces locally available materials that hardly afford construction of a basic dwelling in a vernacular way, i.e. by the dweller as self-builder. Producing and establishing a proper home strands on the mismatch of techniques with the materials, respectively vernacular and commercial. The pavement dwelling is a typical example of the collision of vernacular with commercial.

As for ownership and property, the economic dimension of symbiosis, the pavement dwelling is again emblematic of the interface of vernacular and commercial. The materials somehow come from the market, whereas the land on which the dwelling sits obviously is part of public space, which can only be appropriated with the consent of the local community. A ruling by the Indian Supreme Court in a case of the Bombay Pavement dwellers against the BMC[18] reflects this conflict is. The court issued a judgment that the BMC had the right to keep the pavements free from huts and encroachment as that right superseded the right to life and livelihood of the dwellers as citizens of India (Hollick, 2011; SPARC, 1985). This ruling underlines the idea that public space in the city is public property and that it cannot be appropriated for private

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[18] The Municipal Corporation of Greater Mumbai (MCGM) is commonly known as the Brihanmumbai Municipal Corporation (BMC).

use. In the convivial community, the space between houses is also considered public, but in a permanent state of negotiation. In pavement dwelling, this convivial perspective clashes with the formalized city.

Photo 47. Pavement dwellings in Tokyo. January 28, 2007.

In fully formalized Tokyo, the dropouts from the economy turn to pavement dwelling. There are people who are in desperate deep financial trouble and loan agents do not hesitate to hire gangsters to collect debts. Alex Kerr (2001) explains: "Yakuza [organized crime, SdM] threatens your family, comes banging on your door at night or calls you in the office twenty five times per day. As a result ten thousands of people disappear every year in a process known as *Yonige,* Midnight Run. They leave their homes, change identity and move to another city, all to hide from the enforcers of Japan's consumer loans."

Domicide and Evictions

> "If you go and talk to any of our policy-makers, they still live in a mythical dream world, in which they have these wonderful images that the solution to urban poverty and homelessness is simply for all poor people to go back to their villages", SPARC founder Sheela Patel quoted in (Hollick, 2011).

Although a pavement dwelling provides the basic protection that every human being needs, its own existence is under constant threat. By their sitting on the pavement, narrowing the street and reducing public space, pavement dwellings become problematic for the proper functioning of the city. The local government therefore sees itself entitled to remove the settlers and demolish their dwellings. Although such evictions are legally justified, they are an act of domicide at the same time. People's

homes are killed and the dwelling-occupant symbioses die with them. Suffering the traumatic effects of domicide time after time is what brought pavement dwellers in the Byculla neighborhood to negotiate an arrangement with the municipal demolition squads. The dwellers realized that the already traumatizing event of the demolition of a home worsened by the fact that they received no notification in advance. Demolitions executed on such short notice allowed people just flee their home leaving them no time to take any of their belongings with them. As there was no justification for this additional damage and trauma, it was agreed that dwellers be notified in time so they could properly vacate the place before demolition. In exchange, the dwellers offered to carry out the demolition themselves, which at the same time allowed them to take valuable materials from the site. This way, the demolitions were less stressful and traumatic. Effectively they were no longer domicide. The benefit for the municipality was the reduction of work, waste, and social unrest.

Legal Context

The legal situation of pavement dwellers is different from that of squatters and slum dwellers, who settle on vacant land. The kernel of the difference is that pavements are a public provision affording safe circulation of pedestrians, i.e. they are not just strips of land where sometimes people walk. For the law therefore, pavement dwellers have always been illegal trespassers on public property. The Bombay Municipal Corporation Act 1888 actually makes the removal of "obstructions and projections in or upon streets, bridges and other places" an "obligatory and discretionary duty of the Corporation". Most of Mumbai's policies regarding pavement dwelling therefore consisted of clearing sidewalks of hutments and deporting people.

After massive evictions and demolitions by BMC in July 1981, journalists and civil rights activists filed petitions and subsequent appeals in order to halt the frequent violence against pavement dwellers. In the course of this process, all aspects of the problem became visible; the impoverishment of the countryside, the persisting housing crisis in Mumbai, the abundance of labor force leading to widespread underpayment of workers mostly below the minimum wage. In July 1985, the Supreme Court judged the evictions were legal but that 'prior notice' should be given to those affected. BMC was not obliged to provide an alternative location to the evicted.

The 1995 Slum Rehabilitation Act protects from eviction, those who can produce a document proving they lived in the city of Mumbai before January 1995, regardless of the type of municipal land, i.e. including pavement dwellers.

From *Kacca* to *Pucca*

The pavement dwelling as a building consists of a roof held up by some structure, walls making it a room, and of course a door. In its most basic form, it is only a roof made of plastic sheet or blue tarpaulin. Walls are made of cardboard, hard board, corrugated

steel or any sheet form material, as in Photo 45. In cases where pavement dwellings not removed by authorities stand for longer time, improvements are made with for example masonry walls, the construction of an additional floor creating a loft, and the use of cement fiber sheets for roofing (Photo 48, Photo 49, and Photo 55). This transition from *kacca* to *pucca* is similar to what we saw in vernacular houses. Note however that in pavement dwelling, the distinction between *pucca* and *kacca* can be quite diffuse. Metal sheeting for example, is a *pucca* material, whereas when recycled in an improvised pavement dwelling, it is more *kacca*. It is therefore not only the materials but also the ways they are applied that make a structure *pucca*. In addition, kacca and pucca are relative qualities and not absolute, i.e. a structure is more *pucca* vis-à-vis another structure.

From the materials, one can also tell something about the security of tenure of the dwellers. The more permanent the material, the more permanent is the whole situation. The existence of a *pucca* version of pavement dwelling illustrates the permanence of such dwellings and shows that the dwellers are not the transient people often thought to be.

Photo 48. N.M. Joshi Marg, Byculla, Mumbai. Pavement dwellings are becoming more and more *pucca*. These dwellings are quite permanent as also the neat use of paint is telling. All of them have a loft. January 20, 2010.

Photo 49. *Pucca* **pavement dwellings built of masonry show the permanence of this way of living. Painted in blue, matching the tarpaulins and drums, they mark a quality of more than subsistence level. January 20, 2010.**

The layout of the average pavement dwelling is basic: it is one room of 5 x 5 to 5 x 10 feet. The size depends on the width of the pavement and informal agreement with neighbors. An average hut in Byculla is 35 to 45 sqft (Hollick, 2011). There is often no further division, as it simply makes no sense to divide an already small space. The one room that serves all purposes is much the opposite of the idea of functionalism, in which every activity, every 'function', gets its own room. From this perspective, functionalism is space consuming. The obvious way to create more floor space in the one-room dwelling is to add a mezzanine or a loft. Thus, the loft typical of vernacular rural architecture is also present in many, if not most, urban pavement dwellings. An important factor in the popularity of lofts is the lack of privacy experienced in one-room dwellings. Being a low space, the loft affords to lie on a bed, and escape the permanent presence of others. The ladder providing access to the loft is outside, as inside it would take valuable space. Thus, the loft has an independent access, which adds to the privacy and even affords renting out.

Less handy situations occur too. Sidewalks are the domains of lampposts, fire hydrants, storm drains et cetera, and it is impossible to remove them. Many a dwelling has an awkward piece of street furniture in the room or a lamppost jutting through the roof as in Photo 48 and Photo 49.

Location

Pavement dwellings by their nature stretch out like a ribbon along the streets. This makes them more prone to eviction than grouped pockets of informal settlement, especially where their presence substantially reduces the available space in the street. A narrow road is therefore a more risky location than the wide boulevard in Photo 50.

Photo 50. N.M. Joshi Marg, Byculla, Mumbai. Some houses and a (perhaps sacred) tree block half of this street. Traffic thus leaves space for the pavement dwellers on the far right. January 20, 2010.

Typical of the pavement dwelling is its adhering to a wall or a building. This means that pavement dwellings are an important indicator of the quality of public space in the planned city. Squatter settlements do not occur against a shop window or a house front with door and windows. They mainly cover blind walls and fences with little life behind it (Drawing 2). Therefore, certain urban design facilitates encroachment. In addition, the way to build a dwelling is strictly practical. The roof of most pavement dwellings is sloped up to the wall behind, draining the rainwater to the front and off to the street. If it were the other way round, rainwater would inevitably seep into the dwelling.
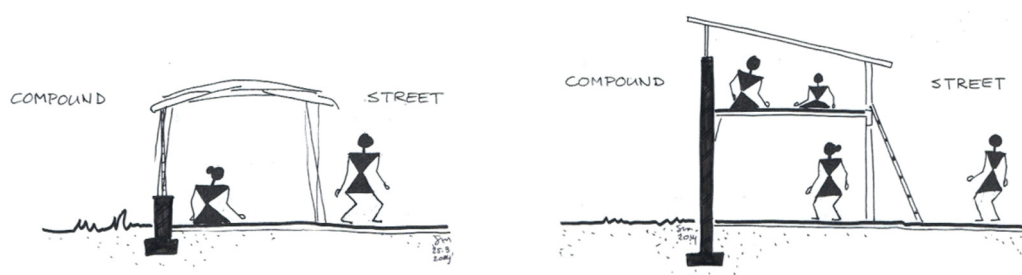
Drawing 2. Walls and fences at the fringes of compounds offer support for pavement dwellings.

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Since in a city buildings generally bound the streets, pavement dwellings always sit against something like a wall or a fence. Such a background is a welcome structural support and can be practical in its details. Concrete ledges serve as kitchen shelves; steel bars make coat racks. Consequently, pavement dwellings often sit around compounds and on bridges, as in Image 3, Image 4, and Photo 53.

Photo 51. Pavement dwellings lining a compound. April 17, 2013.

Photo 52. These pavement dwellings sit against a fence that surrounds a compound. The fence keeps pavement dwellings away from the wall. April 17, 2013.

Image 3. Pavement dwellings typically sit against boundary walls of compounds. Meghraj Sethi street, which runs south of the Khatau Mill compound, lined with pavement dwellings. Image Digital Globe / Google.
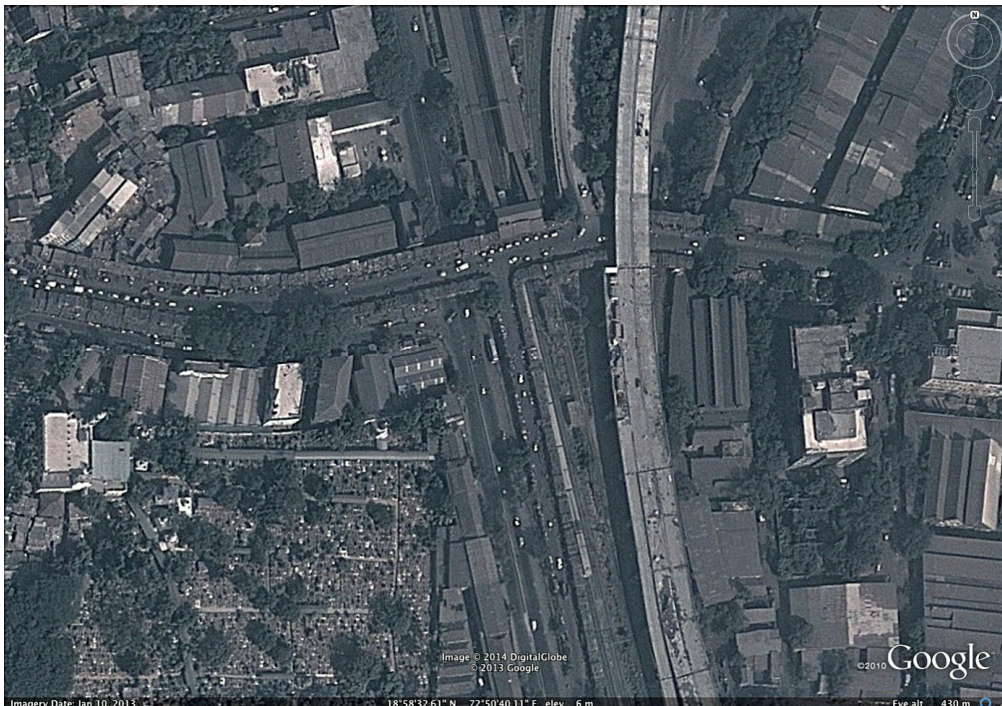
Image 4. Pavement dwellings lining elevated roads and a bridge over railway lines in Byculla Mumbai. Image Digital Globe / Google.

Photo 53. Pavement dwellings on a bridge over Reay Road use the bridge's fence as back support. January 10, 2010.

A special case is a fence available on the curb of the sidewalk, as in Photo 54. It is a rare occasion but it is very effective, as only a tarp and a couple of sticks complete the shelter. Surprisingly, this over-formalization of public space by means of a fence on the curb has created ideal conditions for informal settlement.

Photo 54. Ballard Estate, Mumbai. This tarpaulin spanning the sidewalk between a wall and a fence is probably the simplest variety of all pavement dwellings. January 11, 2010.

Way of Living

Photo 55. Living partly takes place outside the house. A common practice in the countryside, used as a strategy for dealing with little indoor space in de crowded city. January 20, 2010.

Another link with the vernacular house is the way of living. It is actually a key factor in living under the typically cramped pavement dwelling conditions. In the countryside, many activities take place outside the house, whereas the house itself mainly serves for sleeping and storage. A similar way of living marks pavement dwelling, where activities like cooking, washing, and even bathing take place in the street, right in front of the dwelling. The outdoor space thus is an extension of the home. The symbiosis of the dwelling and the dweller in fact extends into the outdoor. This shows that also in pavement dwelling the word dwelling means both the physical structure and the activity. Pavement dwelling is a way of living, a way of life.

Water

One of the main purposes of a dwelling is to protect its occupants from water, regardless of where it comes from, rainwater, groundwater, or flooding. Certain activities however, like cooking and bathing, come with use of water. In basic dwelling, these activities take place outside. The question in this chapter therefore is 'how did the use of water enter the home?' This chapter investigates the evolution of water management in the home.

In a household, water can serve as drinking water, for bathing, washing laundry and dishes, and sometimes for cleaning the home itself. Drinking water has to be clean but makes only a small portion of a household's water consumption. It is therefore practical to distinguish between potable and non-potable water. Potable water is fetched from a well or a pump, whereas for washing, one can also use a pond or a river.

Photo 56. From left to right: this *otla* behind a Bihar house affords bathing (in cubicle), washing (laundry on fence), brushing teeth, and dishwashing. Wastewater flows directly into the rice paddies behind the fence. August 2, 2014.

In a small dwelling, the spill that comes with bathing and dishwashing is easier to handle outside than inside. Just like fire in a fireplace, water often has a dedicated place, e.g. the kitchen or the bathroom. In India, such an outside wet place is called an *otla*. Obviously, the main ingredient of an *otla* is a water tank or a pump. Often, the *otla* has something of a floor, like flat stones, bricks, or concrete. In order to see how the use of water has entered the dwelling, in the following the *otla* and the *mori* are identified in several types of dwelling. *Mori* is the interior version of the *otla*. Perhaps the most basic *otla* is that of the pavement dwelling, where the presence of water is all that makes it an *otla*. Water is kept in a jar or a bucket; the street is the hard flooring.

Photo 57. Pavement dwellings are the most basic settlements in the city. The *otla* is simply the space in front of the dwelling. Dockyard Road Mumbai, January 9, 2010.

Whereas in *pavement* dwelling the *otla* is in front (Photo 57), in *settled* dwelling the *otla* is either in front or behind the dwelling. Alternatively, the water storage is outside, as in Photo 59, while its use is inside, in the *mori*, as in Photo 62 and Photo 63.

Photo 58. *Otla* in front of slum dwellings in Dharavi. January 11, 2013.

Since paths, alleys, and streets are the routes by which water is brought to a dwelling, by either carrying or piping, *otlas* and storages normally sit in front. It takes planning to disentangle the water infrastructure from pedestrian circulation and get the wet part

to the back of the dwelling. In Dharavi Transit Camp for example, the alleys are alternating dry and wet. Front doors open to the dry ones, whereas piping and gutters are in the narrow service alleys at the back, as shown in chapter Street, page 164. The pattern described here is what makes gutters and wastewater considered emblematic of slums. However, the segregation into different types of infrastructure (made possible by taking the human water carrier out of the transport system) marks a modern city. Subsequently, the modern city presents the lack of segregation as problematic.

Photo 59. Water barrels in front of dwellings in Dharavi Main Road. Since tap water runs only during one early morning hour, storing water is an essential part of the daily routine. November 19, 2012.

Tap water is rationed and available on a set time, for often no more than one hour per day. For use during the rest of the day, water must be stored in tanks and barrels. Since all households in the neighborhood replenish their tanks at the same time, the pressure in the water system is low and water cannot reach higher than ground floor. In order to get the water to the upper floors, it is necessary to install electric pumps, and that is indeed what people do. Consequently, water is sucked from the taps and pressure drops even lower. As a result, taps sit near to the ground (as in Photo 59) and in many a dwelling no piping is found going further up. Instead, a hose is let down from the upper floors and connected to the common electric pump every morning. The pump serves several households after another. Water supply slots are often at inconvenient hours, which is why neighbors take turns in performing this daily ritual. It is a job with responsibility since oversleeping causes serious inconvenience to others. Water shortage is not a specifically Dharavian problem. The juggling with tanks, barrels, and pumps is found throughout India. Those who can afford it install their private pump and fixed piping.

Photo 60. A man is bathing on a balcony *otla* at the back of his house in Bhatiya Nagar, Dharavi. Wastewater flows directly into the canal. The setup is identical to the Bihar example in Photo 56. December 31, 2012.

Photo 61. The students living in this Dharavi dwelling use the kitchen worktop for television and study books. July 19, 2014.

Photo 62. *Mori* with water tank (yellow), steel drinking water jar, and terra cotta water purifier. July 19, 2014.

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Photo 63. Walls around this *mori* afford use as a bathroom (not toilet). The kitchen worktop has neither a tap nor a sink. A water tank sits on top of the *mori*. January 16, 2013.

A *mori* looks much like the concrete slab of the *otla* in Photo 56. It often sits next to a kitchen worktop as dishwashing takes place in the *mori*. Water is kept in a barrel as in Photo 62, or in a tank on top, Photo 63. Potable water is kept in steel jars. Although water in the jar and the barrel come from the same tap, only the water in the jar is suitable for consumption. Regular emptying and cleansing is easier with a jar than a bulky barrel. The jar is filled from a tap, not from the barrel.

Laundering requires large quantities of water, which is why it is often easier to take the laundry to a pond or a river. Drying on clotheslines requires space, which is a second reason to launder outside the home. Professional launderers of course prefer not to waste energy on carrying water and locate themselves close to a reliable water supply, e.g. a river. The transition from traditional context into the planned city is visible in the following three examples. In Varanasi, laundry services are on the banks of the river Ganges (Photo 64). Clotheslines span the common space on the banks or, in formal city terminology, the 'public domain'.

Photo 64. Laundering is easier in a river. Ganges River Varanasi, December 13, 2012.

Photo 65. Dharavi Dhobi Ghat, a pond fed from a small canal, is the home of professional laundry services. Laundry is put to dry along the adjacent railway tracks. January 20, 2010.

In Dharavi Dhobi Ghat, the pond is equipped with hard banks (Photo 65). Since space is scarce, the beds of the adjacent railways serve for drying (Photo 66). The pond itself has become a built structure, whereas by lack of common land, launderers encroach with their activities into railway land. This encroachment is only possible because the activities of both parties in principle do not interfere with each other. It is the railway company's concern that accidents with launderers will disrupt train services. Nevertheless, since there is no other option, launderers keep using the railway land.

Photo 66. By lack of open space in Dharavi, launderers use the adjacent railway land for drying. January 4, 2013.

The third example is Mahalaxmi Dhobi Ghat where the municipality built the infrastructure and launderers rent the basins. Clotheslines span the basins (Photo 67). Here, the laundry service is embedded in the formalized static city.

Photo 67. Part of Mahalaxmi Dhobi Ghat in Mumbai. The municipality rents out the basins to launderers. November 4, 2010.

In the above, we have seen that piped water gradually replaced fetching water in jars, and that laundering moved from a public place with natural open water, to a closed institutionalized built-up infrastructure. This transition comes with a reduction of

social interactions. Common water sources are social hotspots. It is where people meet and exchange news, just like at the coffee machine in today's office. The introduction of piped water in the home thus reduced the number of casual encounters outside the home, affecting in particular the women who run the household.

Photo 68. A step well in Abhaneri, Rajasthan, affords access to deep groundwater. Water tanks in Mumbai were less deep but played a similar important role as social hotspot. December 3, 2012.

Step wells are pits that afford access to deep-laying groundwater. The first step wells in India were built in the sixth century. Because of their importance, they are often of a grand architecture. The water in step wells is considered a symbol of the river Ganges, and bathing in it is an important Hindu practice (Neville, 2009). Matthew Neville describes the role and history of water tanks (i.e. step wells) in the urban fabric of Mumbai. Step wells in Gujarat and Rajasthan are often deep and found separate from settlement areas. Tanks and stepped ponds however, are found in villages and cities.

Since many tanks in the city fell into disuse after the introduction of motorized pumps, many were filled and consequently disappeared from the urban landscape. Similar to other water sources, these tanks and step ponds are important meeting places often accompanied by a temple. That social function is, similar to other water sources,

doomed to disappear in the wake of mechanization and the introduction of piped water.

Photo 69. The local water source is a social focal point for a community. Painting in Warli style by artists of the ASSP Centre in Masvan, 2013.

Eventually, mechanization has led to a situation where ideally all water is supplied in the form of piped potable water, although the major part of water consumption could be covered with non-potable water. Or as Pierre Frey once put it: "Today's western society is the only one that defecates in its drinking water."

Toilet

The toilet is the least holy place in a home. It is the counterpart of the kitchen, the most sacred. Homes as they used to be did not have an interior toilet. This chapter will investigate to what extent today's cohabitation of toilet and people is voluntary or imposed.

From Nothing to Necessity

In the philosophy of *Vastu Shastra*, toilets and bathrooms are a major source of negative energy, loss, and financial problems. In a home, toilets must be separate and not attached. In *Feng Shui*, toilets are equally problematic. Apparently, a toilet is a burden to the home rather than a convenience, not to say that a toilet does not belong inside the home at all.
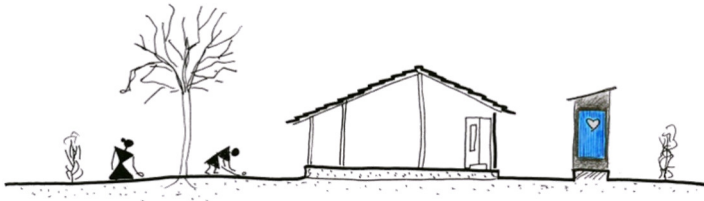
Drawing 3. In rural dwelling, the toilet is detached from the home.

In the countryside in Bihar, as an example of rural low-density habitation, it is common to defecate somewhere remote in the fields or the jungle. Toilets therefore have no reason to exist. In such low-density settings, nature is well capable of absorbing human excreta. Only when a village reaches a certain population, the capacity of the surrounding nature becomes insufficient. The way to avoid further pollution of the environment is to collect human waste by establishing toilets. Toilets are waste collectors and designed to prevent involuntary confrontation with other people's bodily waste.
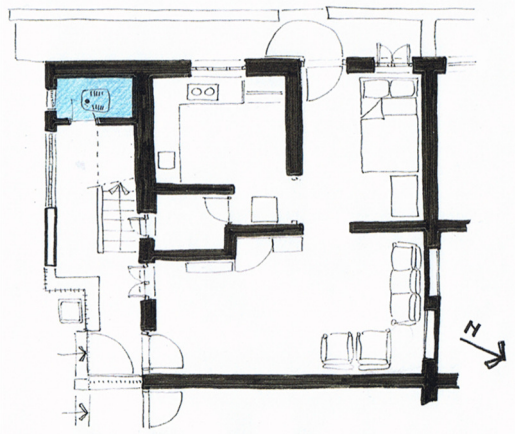
Drawing 4. Although the toilet (top left) is no longer physically detached from the house, it is only accessible via the veranda and thus outside the home.

Toilets in rural areas are usually detached from houses (Drawing 3). If space around the house does not allow detached building, the physically attached toilet is preferably only accessible from the outside (Drawing 4).

Drawing 5. In the modern condominium, the toilet is inside the home.

The modern urban home is equipped with an interior toilet. Since everything outside the front door of the house is public or communal space, exterior access to the toilet is no longer viable (Drawing 5).

This transition from a detached to an interior toilet is a critical juncture in the symbiosis of people and building. Proper functioning of the home means nourishing the family, hence the holy connotation of the kitchen. Keeping threats like contamination at bay is essential to the health of the household. Diseases are nature's response to crowding and can easily spread in the home where people are in close proximity to each other. Placing the activity of defecating inside the home therefore is counterintuitive and requires a fundamental change in lifestyle. This change is only possible with the support of technical provisions and requires major discipline regarding hygiene. The presence of sewerage systems alone is not enough. Since most of them require water for their functioning, reliable uninterrupted water supply is of critical importance. Moreover, it is in the nature of sewerage that clogging further down the system can cause flooding inside the home. Such problems are beyond the control of occupants, and it is understood that people avoid at all cost the risk of having excreta flow into their home. Even in high-rise, some people prefer not to use the built-in toilet. One interviewee mentioned an alternative use of a condominium squatting toilet: the design of the bowl, two steps on both sides of a hole, perfectly affords use as a stove. It illustrates that the design may be a toilet, but practice really defines its use. Turning an unholy concept into an element of sacred domestic use is an illustration of the challenges that occur in the transition from a vernacular to a modern lifestyle.

The principle of having toilets outside the home is visible in the design of *chawls*. These residential buildings, originally constructed between 1920 and 1956 by factory owners for their workers, consist of typical one-room tenements with shared bathrooms and toilets.

Photo 70. Boys check a detached toilet in Navrang compound. This toilet discharges directly into a branch of Mahim Creek and is therefore independent of sewerage systems or water supply. January 15, 2009.
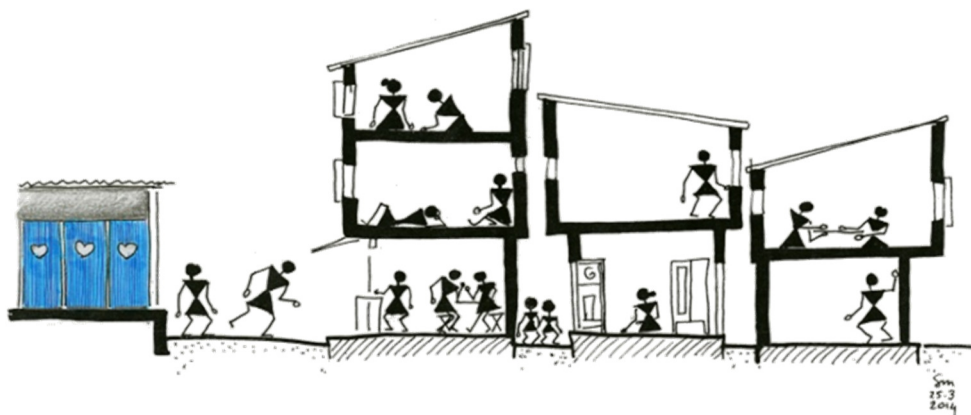
Drawing 6. In informal settlement, toilets are clustered and shared, still put well outside the home.

In most informal settlement therefore, toilets are not built inside dwellings. This finds its origin in the way of life in the countryside, where a toilet is not part of the home either. Since adequate sewerage, water supply, and ventilation are all major issues in slum dwellings, keeping the toilet outside the home is the best way to avoid problems. However, since urban informal settlement takes place in areas already densely inhabited, creating (detached) toilets is nearly impossible. As a result, there is a persistent shortage of toilets, and people fall back to the rural practice of defecating in the field, which in the city means: in the urban jungle. Popular places are uninhabitable nature, garbage dumps, and government land like railway tracks. It goes without saying that the dense population of urban informal settlement causes the supply of human waste to exceed the environment's capacity to absorb it. Since everybody understands that defecating near dwellings causes nuisance, a clear

demarcation is often visible between built up area and wastelands. Very young kids are exempt from respecting this segregation since wastelands are not safe for them. They defecate in the street, preferably on garbage collection spots. Having to go to a wasteland is especially awkward for women, as it exposes them to potential harassment. This makes the need for proper toilets even more urgent.

Photo 71. The inhabited city physically demarcated from the wasteland at Mumbai's Worli Koliwada seashore. People use the wasteland for dumping garbage and defecating. April 7, 2013.

Photo 72. Roadside toilet block in rural Vasai. Collecting human waste is contrary to the traditional practice of diluting it in the environment. February 3, 2010.

Communal toilet blocks are the compromise over not wanting a toilet inside the home, having no space for a private toilet at all, the need for a safe toilet, and the need to reduce the burden on the environment. A study on toilet blocks in Dharavi (Bouchez, 2012) showed that the quality of a toilet block (cleanliness and technical maintenance) is related to the degree of institutionalization.

Photo 73. Communal toilet blocks replace the ´urban jungle´ as defecation facility. April 20, 2013.

Photo 74. In pay-per-use toilets run by entrepreneurs or the local community, financial profit is the incentive that keeps the place clean and well maintained. Municipality funded free toilets lack such an incentive and consequently become run down rapidly. November 28, 2012.

A family owned toilet, for example a locked single toilet in a communal toilet block, performs well, whereas municipality-run toilet blocks tend to fail due to lack of incentive for the personnel. Staff receives its low salary however little effort it puts into keeping things tidy, which is also why many have (more profitable) side jobs. Most common nowadays are pay-per-use toilets (Photo 73 and Photo 74) where profit follows performance. One can use a toilet for the price of one or two rupee. Since there is competition among toilet blocks, neatness will yield more income to the staff. In order not to encourage urinating outside, the use of urinals is usually free of charge.

Photo 75. For Worli Kolis, the shore is a reliable toilet flushed by the sea keeping regular hours. April 7, 2013.

The practice of not having a private toilet inside the home is not limited to urban informal settlement or rural areas. In Worli Koliwada, a fishermen village now part of the city of Mumbai, the shore is the place to go when in need of relief. It is frequently flushed by the tide of the Arabian Sea (Photo 75).

The reluctance regarding built-in toilets is visible in their design. Most common is the model affording squatting over a hole in the floor. The way it is used is identical to the traditional practice of the field. The western model on which one can sit is less popular since it requires physical contact where instinct says to avoid it. For many it is a step further down the line of sharing something that ought not to be shared at all.

The desired segregation of the home and the toilet is also recognizable in the Japanese practice of wearing special slippers when going to a toilet. Although toilets are nowadays fully integrated in the home and the bathroom, it is common to wear special

slippers when entering a toilet. These slippers are not to be worn anywhere else, and are left at the toilet door after use. Their design is such that anyone can recognize toilet slippers. This practice reenacts the use of an outdoor toilet in which wearing slippers is a way to keep feet clean, whereas outdoor footwear is never worn inside the home, especially when worn near a place of defecation. In today's conditions, this practice may be obsolete as a hygienic precaution; the ritual of changing slippers when leaving the toilet however, marks the segregation of the home and the non-home, the sacred and the non-sacred.
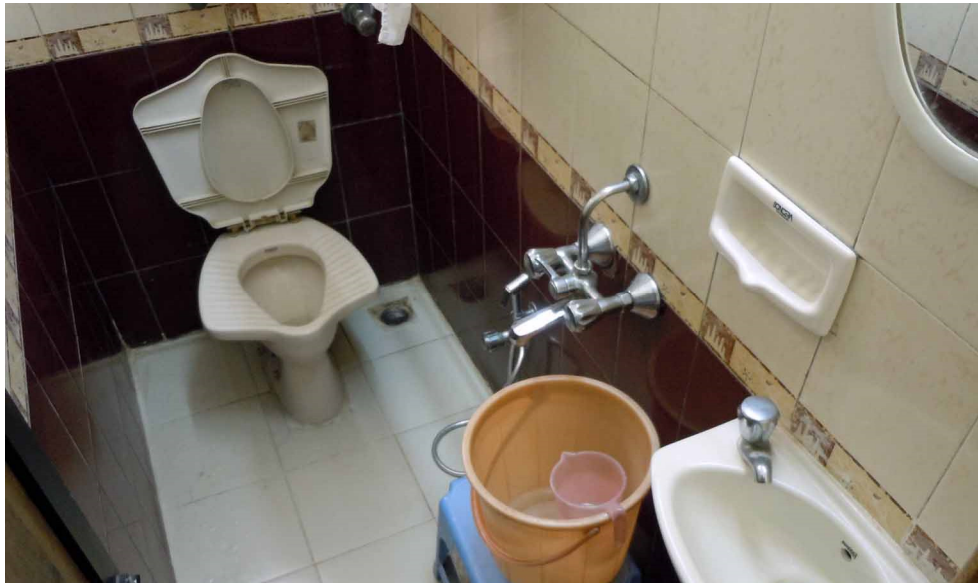

Photo 76. An Anglo-Indian toilet bowl, also known as 'healthy toilet', affords both squatting and sitting. December 21, 2012.

Public toilets are anyhow perceived as unclean. Even the well-kept toilets at EPFL cannot escape the prejudice. Debates with students revealed that the fore rooms, often littered with paper towels, are so messy because picking up a paper towel is an unhygienic act. Although the towels are only used for drying clean hands, and everything in the room is demonstrably clean, rationality and sense of responsibility fail to overcome the instinctive aversion to sharing a toilet.

Provision of toilets is an important instrument in keeping cities habitable, and the availability of public toilets shows a city's ability to facilitate its citizens. Most directly affected by the absence of toilets are the homeless. Since governments consider the presence of homeless, squatters, and informal settlers illegal, their primary reaction is often to deprive them of facilities. Provision of toilets might be mistaken for a recognition of their presence, and unavailability of toilets is seen as an important element in discouraging people from staying in the crowded city, or as Mike Davis in (Amster, 2008) put it: "Public toilets have become the real frontline of the city's war on the homeless." However, the city of Mumbai understood that such a policy is untenable. Toilet blocks are nowadays established near pockets of informal settlement.

Thus, pavement dwellers and homeless people increasingly have access to public toilets. This is only possible because public health has priority over formalization.

What It Tells Us

The toilet is the part of a building least willingly shared. In 'primitive' building, the toilet does not exist, or is a separate structure at considerable distance from the main building. A distant toilet is preferably shared with as few people as possible. Only buildings with sufficiently reliable utilities like water and sewerage, afford incorporation of the toilet. The desire not to share a toilet however is visible in the homes of the wealthy, where every bedroom is equipped with a private bathroom. The paradox of the toilet is in its purpose to protect us from other people's excreta by *collecting* human waste, and thus going against the human instinct to *avoid sharing* places where others defecate. The well-maintained shared toilet is therefore inevitably considered unclean, whereas a toilet used by a single individual is still perceived clean, however dirty.

The toilet is an invention that affords living in high densities, not to say that cities owe their existence to toilets. The shortage of toilets in informal settlement is caused by the fact that only a municipality can deal with the scale of the required sewerage. People and communities can built houses and establish schools. When the municipality does not provide necessary services however, toilets will not function and people cannot but fall back to relieving in the urban jungle.

The earlier mentioned study by Bouchez (2012) revealed that communal toilets on a pay-per-use base perform better than free of cost municipality toilets. Kurokawa (1992) argues that in modernization of cities, urban space is segregated into private and public at the cost of the common space. Here is an important parallel with the issue of toilets in slum areas. It shows that public (municipality) toilets or private toilets (in the home) cannot easily compensate the loss of the communal lavatory (as in the field). The communal toilet bears the closest resemblance of going in the common fields. The *pay-per-use* aspect comes from the division of labor, typical of city life. Both the public and the private toilet are alien to convivial life.

In comparison to the natural way practiced in the remote hamlet, toilets are artificial and an intrusion of the home. In the rural setting, activities like defecating and having sex are performed in privacy, i.e. out of sight of the home, for example in the jungle. In the modern age, privacy moved into the home, into separate rooms. In the symbiosis of people and building, the toilet is emblematic of how instinct is replaced by rationalized behavior and typical of the profound changes that come with modernization.

Settled Dwelling

Whereas pavement dwellers squat on land specifically designated for traffic, other people manage to find vacant land and build a dwelling there. This chapter investigates several types of housing created for or by migrants to the city, other than pavement dwellings. The term *settled dwelling* is used here as a container term in order to distinguish from pavement dwelling. To the settled dwellings discussed here, belong *chawls*, mansions, informal settlement, hutments, and Site & Services houses.

Photo 77. *Chawls* were originally built for textile workers. Byculla, April 17, 2013.

Chawls are residential buildings originally constructed between 1920 and 1956 by factory owners for their workers (Photo 77). They consist of typical one-room tenements with shared bathrooms and toilets. As is common in tropical climates, a *chawl* has a veranda where one can stay out of the sun and enjoy a cooling breeze.
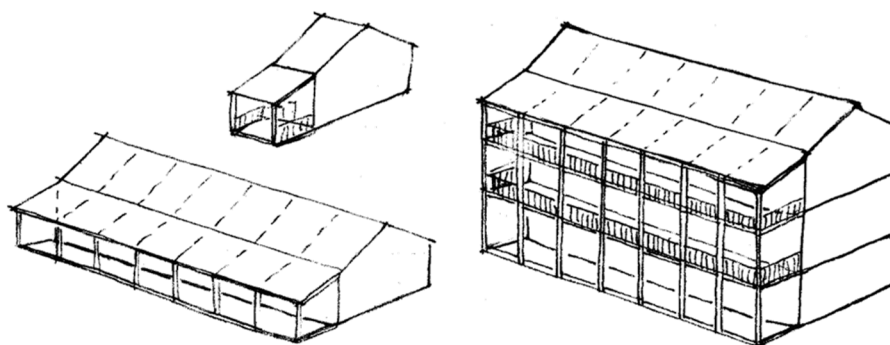
Drawing 7. The typical rural dwelling with its veranda is origin of a unit in *chawls*. A *chawl* is a row or a stack of tenements.

Tenements in a *chawl* therefore are not so different from rural dwellings, except being built in a row, sharing sidewalls, and covered with one continuous roof, as shown in Drawing 8. The main difference from the common rural dwelling is in the way *chawls* are developed. Where the single dwelling is developed by the owner/occupant, i.e. in a

vernacular way, *chawls* are typically developed without involvement of the tenant/end-user, i.e. non-vernacular. Although the design of the *chawl* has its origin in vernacular architecture, the process in which it is produced is industrial and commercial.

Chawls were meant for (mostly single) male migrants to the city but gradually were occupied by families. In order to increase living space, people converted verandas into rooms. As is common in ground floor dwellings, outdoor space is easily used as spillover. As Bombay's housing shortage persisted and buildable land became evermore scarce, a simple way to allow more *chawls* was to build them in a stacked form, as shown in Drawing 7. Whereas in the ground floor *chawl* a veranda is private space in open connection with the street, the connected verandas in the multistoried *chawl* serve as common galleries. This shift in the private-common dialectic is discussed in detail in the chapter about Street (page 164).
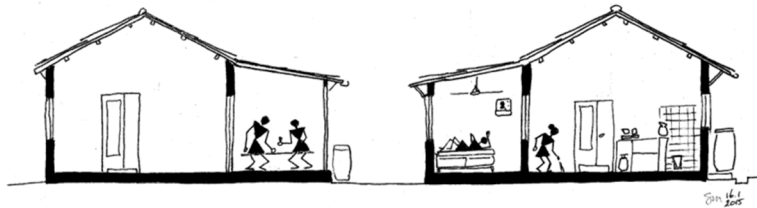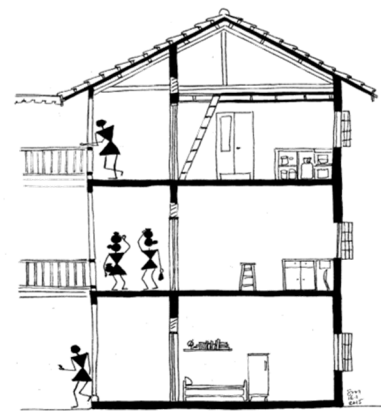

Drawing 8. The dwelling's veranda is overbuilt in the two-room chawl.

Drawing 9. The veranda as common gallery in a multistoried chawl.

Since the rural house often has a detached toilet, an outhouse, toilets for multistoried *chawls* are in the form of common toilets and bathrooms. In general, the individual tenements are equipped with a *mori*. The combination of typical tenement units, galleries, staircases, common bathrooms, and toilets makes an effective set of building blocks affording a diversity of *chawl* designs. A typology of *chawls* is described in (Adarkar, 2011).

Photo 78. *Chawls* in Dharavi Koliwada. Verandas converted into rooms. January 13, 2009.

As mentioned, the end-user had no role in the development process of *chawls*. This was even more apparent in the context of Bombay's housing crisis. Since plenty of tenants were available for every built chawl, there was no incentive to build high quality. Open space between chawls was kept to a minimum, as was maintenance of the buildings. Occupants were not in the position to successfully demand improvements. In **INDUSTRIALIZATION AND THE HOUSING PROBLEM IN BOMBAY, 1850-1940,** Frank Conlon (1984, cited in (Adarkar, 2011)), observed that the British administration rarely consulted the people who occupied the crowded *chawls* regarding their needs and actual living conditions, although the poor conditions were thoroughly discussed by prominent Indians and British officials. Conlon concludes that the ultimate flaw lay in "an inadequate understanding of the diversity of needs and interests of the poor". This 'inadequate understanding' however is too vague an observation to be 'the ultimate flaw.' More likely, the fact that tenants in *chawls* have no authority or position as investor deprives them of exercisable power. Conlon's observations show that stakeholders do have an eye for the position of the tenants. The fundamental problem however is that tenants are not part of the power equation. This problematic will be further discussed in the chapter about Slum Improvement (page 261), including the extreme case of the very poor who are given housing free of cost and consequently hold no stake at all.

Mumbai is a peninsula composed of islands and reclaimed land. Villages on the initial islands therefore were mostly founded by fishermen. Today, these villages are part of the city but still bear the name *koliwada*, i.e. fishermen village. Dharavi too has its *koliwada*: the neighborhood along Dharavi Main Road, stretching from Navrang Compound to Station Road. Since Koliwada has a history of several centuries, house-owners have title to the land and the overall appearance is that of a compact village with mansion-type houses and narrow alleys. It is only since a few decades that population density in Dharavi got so high it spilt over to Koliwada and brought all kind of improvised settlement into the already densely built village. As will be discussed in the chapter about Incremental and Encroachment (page 247), such later additions are readily recognizable, as they seem alien to the initial buildings. Moreover, this characteristic works two ways, i.e. one can recognize informal settlement not belonging to Koliwada by the less alien appearance of additions.

Many of Dharavi's residents came to live there only after being evicted somewhere else. Kalpana Sharma (2000) even argues that Dharavi's existence is based on evictions. People from Saurashtra in Gujarat for example first squatted in South Bombay. After being evicted there and from other places again, they eventually settled in Kumbharwada where today they run the pottery industry. Bhau Korde explains that for migrants from South India, moving to the slums was a way to escape from the religious restrictions that kept them prison in the low ranks of untouchables.[19] Emblematic of

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[19] Dharavi's freedom of caste-based oppression was a pull factor in the Tamil diaspora (Clothey, 2006).

this breaking free is the erection in 1912 of a Ganpati temple in Dharavi by women, who until then were not allowed even to enter a temple.[20]

Informal settlement is what the major part of Dharavi is built of. Houses vary from right-out *kacca* to fully-fledged mansions. In *Incremental Housing and Cumulative Growth Pattern,* Sonam Ambe (2013) describes a typology of informal settlements in an evolutionary order, Ambe distinguishes five stages of development, called 'Moments.'

Moment 1: The Settling

Drawing 10. Settling starts with a structure of bamboo poles and plastic tarpaulins. The main arrangement consists of segregating the dry part of the household (interior) from the wet part (exterior), as explained in Water (page 140). Image courtesy Sonam Ambe.

Moment 2: The Hesitation
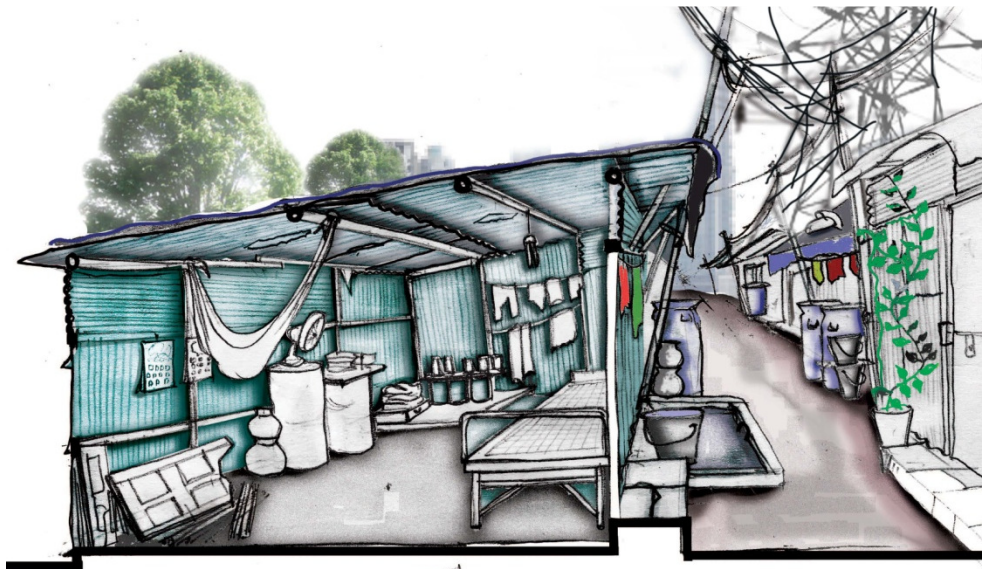
Drawing 11. In the year that follows, the structure is patched with sturdier materials like tin sheets, wooden doors. The wet *otla* is outside. Image courtesy Sonam Ambe.

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[20] Bhau Korde in interview with SdM on November 10, 2012.

Moment 3: Towards *Pucca* Permanence

Drawing 12. Once residents have more security, they are willing to invest in *pucca* materials, e.g. bricks, cement mortar, asbestos roofing, et cetera. Wet place *(mori)* is now inside. Image courtesy Sonam Ambe.

Moment 4: The Stack
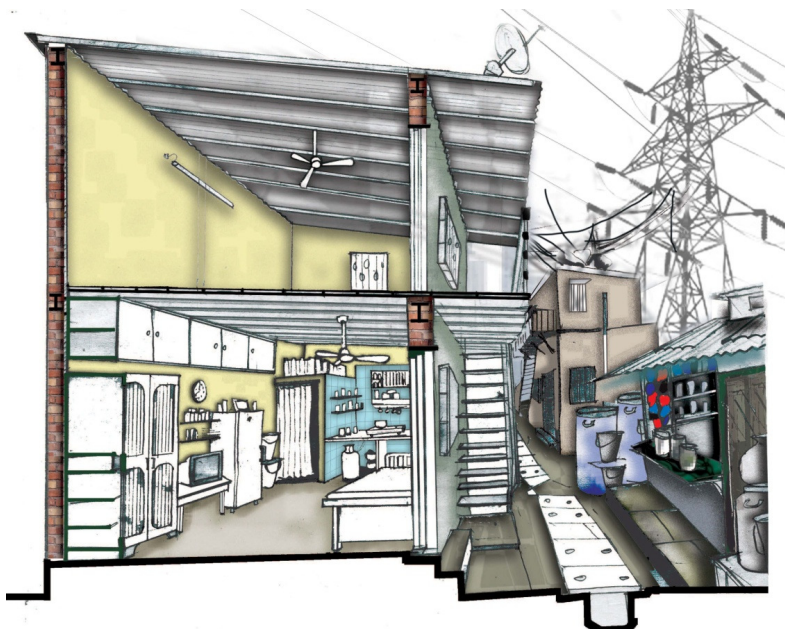
Drawing 13. On a pucca house, it is possible to have a concrete roof, which can serve as floor for a next story. Thus, dwellings can be stacked. Such stacked dwellings are not necessarily entirely pucca. One may find a Moment 3 ground floor with Moment 2 dwelling on top. Image courtesy Sonam Ambe.

Moment 5: The Mansion
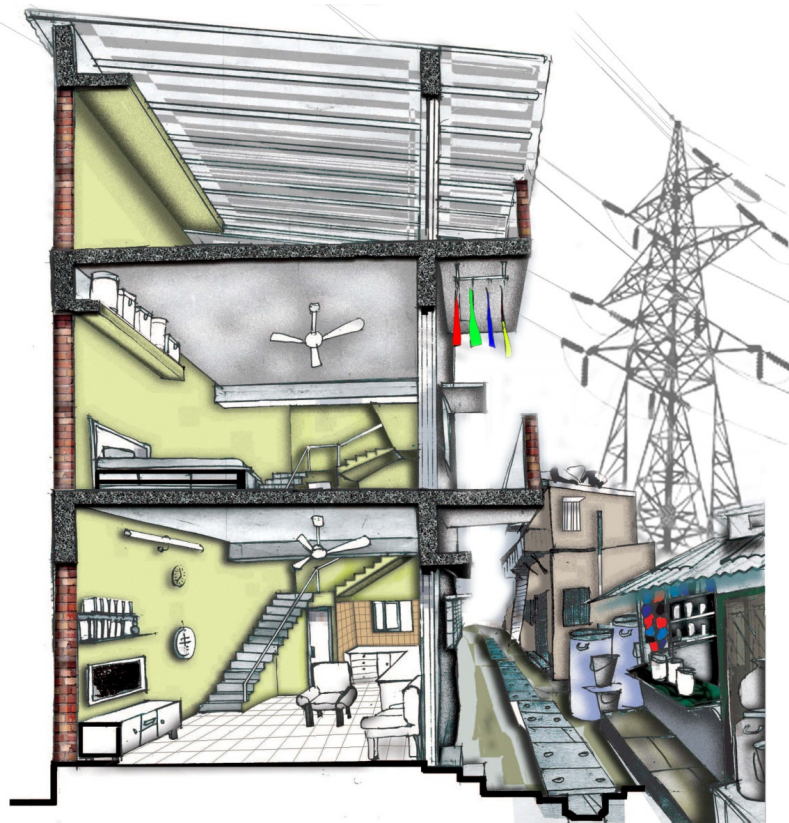
Drawing 14. Further extension and improvement is reached through full replacement of the stacked dwelling by one comprehensive structure. Image courtesy Sonam Ambe.

It must be said though that the physical appearance is not always reflecting the process of these Moments. The step towards Moment 4 for example, is often made by completely replacing the existing structure. Even two-storied stacks are replaced with three-storied and higher. The Moments as defined by Ambe therefore are literally momentary patterns recognized in a rather fuzzy process. Ambe's Moments foremost give insight in how the architecture of settlements is controlled by the transition from informal to formalized dwelling in the city.

Although Dharavi as a whole is often labeled slum, it is more correct to distinguish informal settlement that started as squatter settlements from other development like *chawls,* Koliwada, Kumbharwada, and government sanctioned construction. This distinction is discussed in chapter Slum or Informal Settlement? (page 242).

Another distinctive type of dwelling is found in Dharavi's Rajiv Gandhi Nagar, commonly known as Transit Camp. It was set up in 1984 when authorities widened 90 Feet Road and relocated many residents. Its development is based on a scheme known as 'Site & Services,' in which the municipality sells 10 x 20 feet (3 x 6m) plots of land, including infrastructure for sewerage, water, and electricity. Since residents held title to the land from the beginning, the buildings in Transit Camp look more robust than elsewhere. Moreover, the regular pattern of the plots and alleys reveal the planned

character of the area. The houses have their front door to the wide alleys (6 feet / 1.8 meter) where social life takes place, whereas the backdoors open to a narrow alley serving as *otla* or wet side. As first floors in Transit Camp are often built partly over the alleys, houses have a distinct mushroom-like shape. The more than 6-meter long side façades are easily spotted in Mahatma Gandhi Road (Photo 79).

Photo 79. The typical long façades of Transit Camp on Mahatma Gandhi Road. January 21, 2010.

The Site & Services scheme was widely applied in the creation of Navi Mumbai, the new town across the bay built to relieve the pressure on old Mumbai. Typical of Site & Services neighborhoods are the adequate layout of the streets combined with a great diversity in architecture. Since the owners are the developers, no two houses look the same.

It follows from the above that settled dwelling in Dharavi is a mix of several typologies and that boundaries between these typologies are not always as distinct. One blurring effect comes from the uniformity in construction materials, such as the plastered masonry and ubiquitous asbestos roofing. It is mainly by the shape of the houses that one can distinguish one type from the other.

Street

The segregation of work and living is one of the ingredients, and probably the whole *raison d'être,* of twentieth century urban planning. It is a concept parallel to the division of labor. The idea was that designating specific functions to areas would be more effective in keeping hygienic conditions than having all mixed. It was the ultimate argument the British hygienist movement provided for the historic slum clearances in industrializing cities. By placing industry away from residential areas for example, the nuisance of polluting activities could be minimized and living conditions improved. An important facilitator of this segregation is mobility, i.e. the use of cars and public transport. The street thus became part of the infrastructure needed for this mobility. This chapter investigates the changes that occur in the use of the street when it develops from vernacular to modern.

Before Street

Photo 80. In this Bihar hamlet, only the space directly around the houses serves circulation. All other land is used for growing crop. Jahpa, Bihar, July 29, 2014.

In the remote small village, the hamlet, streets as known from cities are almost nonexistent. Houses are connected by the land around them, which has no specific shape but lies in general higher than the rice paddies. Space between houses doubles as alley. Pathways connect places of certain distance. Since bunds around rice paddies often double as pathways, the network is almost invisible. Many a hamlet looks as if not connected to main infrastructure.

Photo 81. Bunds around rice paddies double as pathways. Many a hamlet has no other connecting infrastructure. Jahpa, Bihar, July 31, 2014.

Roads connecting villages do not only serve as infrastructure for mobility, they also give structure to the built-up area. New buildings are constructed in conjunction with the road, and the ensemble makes a street. The street thus becomes a self-supporting piece of infrastructure. Especially commercial activities benefit from roads and streets. One could say the creation of a street is a step out of vernacular.

Photo 82. Roads segregate land use into traffic and other activities. The roadside too gets a new meaning. Near Sursand, Bihar, July 29, 2014.

Photo 83. Roadside as recycling station. Both the road and the surroundings are kept clean of garbage, whereas cattle and passers-by can collect it as they like. Susant, July 30, 2014.
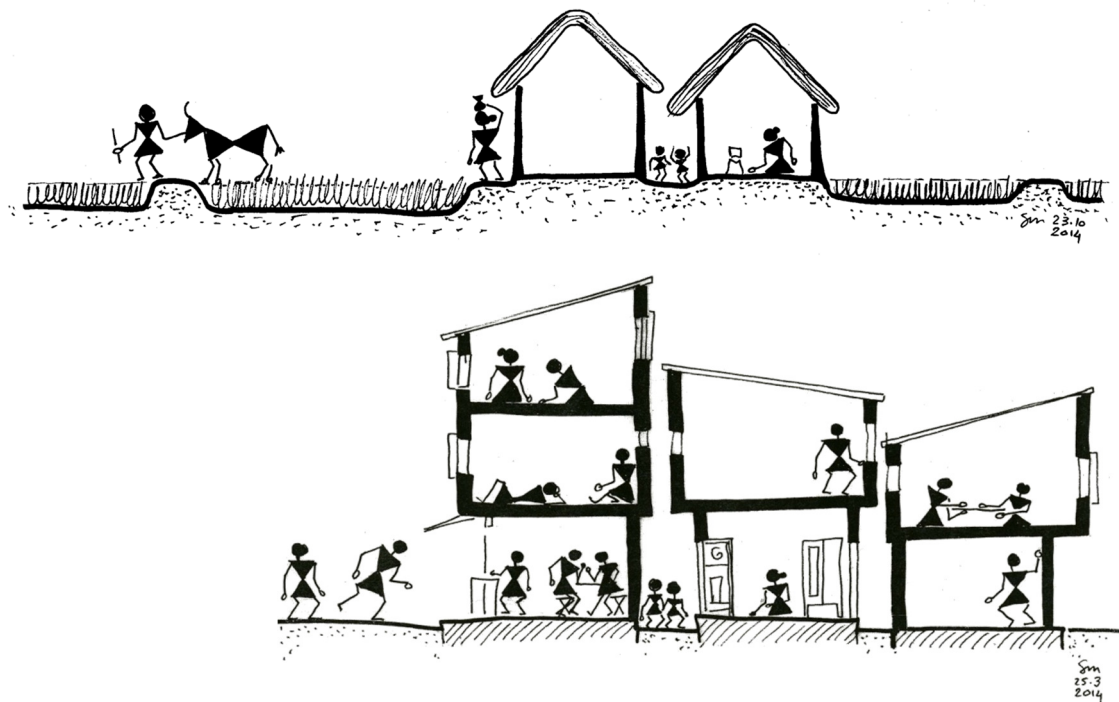
Drawing 15. The pattern of minimum circulation space around houses is present in both rural and urban informal settlement.

The rural pattern of minimum circulation space is also present in urban informal settlement. The typical myriad of narrow alleys is the result of putting houses at a minimum distance. Often, an alley is not wider than needed to allow two people pass each other. The narrowness of these alleys therefore does not necessarily come from a lack of space; it is a pattern familiar to migrants from the countryside. Moreover, the

koliwadas that are now part of Mumbai show the same vernacular pattern. Streets are relatively rare in Dharavi. One of the oldest streets is Dharavi Main road, the backbone of Dharavi Koliwada. Major traffic arteries are the Sion-Bandra Link Road, 90 Feet Road, and 60 Feet Road. Other streets are barely accessible by car.

Photo 84. The regular street pattern of Dharavi Transit Camp (left) surrounded by the irregular slum (top, right, and a strip below). The planned city is at the bottom, separated from Dharavi by railway lines. Image Digital Globe / Google.

Photo 85. In Dharavi Transit Camp, most dwellings sit on narrow alleys whereas only three roads connect to 90-Feet Road (top). The layout is a hybrid of vernacular and urban planning. Image DigitalGlobe/Google.

When in 1984 the authorities gave 90 Feet Road its name by widening it, they dismantled numerous dwellings and relocated people in Rajiv Gandhi Nagar, also known as Transit Camp. This Transit Camp is a piece of planned city surrounded by vast informal settlement (Photo 84). Although Transit Camp's street pattern is a grid surrounded and crossed by roads wide enough to allow cars to pass, most alleys connecting the dwellings are not wider than six feet (1,8m). Transit camp therefore is a hybrid of vernacular and planned urbanism (Photo 85).

Photo 86. Alleys in Transit Camp follow a pattern of alternating circulation alleys at the front of houses (left) and barely accessible service alleys at the back (right). January 17 and 11, 2013.

Transit Camp shows a combination of urban planning and vernacular best practice. Urban road infrastructure and utilities can only be provided by a municipality. Plot size and layout however have much in common with Dharavi's informal dwellings. For example, many of them too sit between front and back alleys as in Photo 86. The back alley results from the need for cross ventilation and escape routes (Photo 85). This practice of front and back alleys also affords a differentiation into dry side and wet side.

Photo 87. Despite Dharavi's high density, many informal dwellings have a front and a back door, i.e. are not built back-to-back. December 29, 2012.

Photo 88. Modern multistoried building lacks the intermediate space of the veranda. Sion Mumbai, March 15, 2008.

An important concept in Indian culture is that of co-existence, in the sense of existing together, unlike the western co-existence that is about existing next to each other. Connection with the street is therefore important and deeply rooted in Indian culture. The street and the veranda are the places where people meet. Replacing slum dwellings by high-rise condominiums therefore is detrimental to social life. Connectedness with the street also shows in the other direction, i.e. the extent to which people take care of

the street. Grounds around multistoried buildings as in Photo 88 are often barely taken care of, whereas grounds around ground floor dwellings are well kept. In densely built ancient cities, roof terraces are the replacement of the veranda (Photo 90). They afford social activities in the open.

Photo 89. Alleys in Dharavi Koliwada (the centuries old village) are of similar size as in 1984 planned Transit Camp. March 18 and 24, 2008.

Photo 90. The ancient city center of Varanasi is a myriad of narrow alleys. Roof terraces afford intermediate space between private and public, as an alternative to verandas. December 16, 2012.

Pavement

An example of the role of authorities in creating road infrastructure is visible in Dharavi's pavement. Still in 2008, roads like Dharavi Main Road and Mahatma Gandhi Road were dirt roads without pavement. It stood out however, that many of the alleys were paved, even remote ones. In narrow alleys, sealing the path is relatively little work and managed by cooperating neighbors. Since mainly local community people benefit from it, paving the alleys is a manageable, shared responsibility. Especially in Dharavi Koliwada and Transit Camp, alleys are well paved. As Koliwada is a centuries old village and the municipality set up Transit Camp, they are both formally recognized neighborhoods, which is beneficial to the sense of community.

In the case of a wider street used by many, the problem lies in the fact that the people who benefit from better pavement do not all belong to the local community. It is easier to negotiate with a limited number of neighbors about collectively paving an alley, than organizing pavement for a street used by thousands. This is where an institution like a municipality is needed. Only such an authority can organize collective resources of sufficient scale. Paving the space between houses is feasible for collaborating neighbors, whereas building roads is the task of (urban) governments. In 2010, Mumbai municipality started paving roads in Dharavi in the framework of the Mumbai City Development Plan 2005-2025.

The Static Street

At the other end of the vernacular - modern range lays the western-European city, where traffic is spatially segregated. An extreme example is the 1970s Bijlmer neighborhood in southeast Amsterdam, with cars, public transport, pedestrians, and bicycles completely separated from each other. Cars leaving the road entered directly into parking garages, from where their drivers walked home to the adjacent high-rise housing through 'indoor streets', all in New Brutalism-style architecture. As a result, the number of people injured in traffic accidents is indeed low but public safety was heavily compromised by the lack of social interaction. Jane Jacobs' (1961) message that the sidewalk with all its differing use is a key element of the great city, proved right. The 1992 Bijlmer revitalization plan aimed at restoring diversity in the street.

Indoor Street

The problematic of the static 'indoor street' is recognizable today in so-called double loaded corridors in multi-storied buildings. In Dharavi, many of the tenement blocks built to replace slum dwellings, consist of tenements on both sides, connected by a central corridor as in Photo 91. In the ground bound slum, a dwelling sits directly to the public realm. In high-rise, one finds corridors and staircases in between. The double loaded corridor is neither public space, nor private. Because of the physical distance created by this 'circulation space', the corridors fail to serve as socially connective space between household and public. At best, they connect households

with each other, but then the buffering effect of the real public street (with Jane Jacobs' busy sidewalks) is missing. Note that the corridors do not function as the vernacular common space'.

Photo 91. Double loaded corridors do not afford the social life known from living ground-bound in alleys. The space is neither public, nor private, nor common. Dharavi, December 28, 2012.

Photo 92. The single loaded corridor in a *chawl* is a mix of veranda and gallery. Parel Mumbai, January 6, 2013.

A more successful variety is the single loaded corridor as found in Mumbai's chawls. The design of a *chawl* is a stack of traditional tenements including verandas. The

connected verandas form a gallery that links with staircases. Three important qualities of the veranda are also present in the galleries. One is the short juxtaposition with the street and its social life, second is its affording cross ventilation of the tenement, and third is protection from the sun while allowing a cool breeze. The double-loaded corridor layout affords none of these.

SPARC's Keya Kunte points out that in traditional houses, the veranda plays an important role in the social life of women. It negotiates the protective nature of the home *vis-à-vis* public space. Double loaded corridors in high-rise do not afford that kind of communication[21]. Sonam Ambe (2013) observed the same quality in 'moment-2' dwellings where the *otla*, the wash place in front of the hut, hosts an important part of women's social life.

Another way to describe the problematic of the double loaded corridor is the use of notions found in Feng Shui,[22] where the front door is the mouth of the home. It is the part by which the home communicates (and indeed feeds). The mouth is part of the façade, the face of the home. In traditional dwellings and chawls, the home faces the rest of the world, whereas in the case of a double-loaded corridor, the tenements face inwards and have their backs turned to the world.
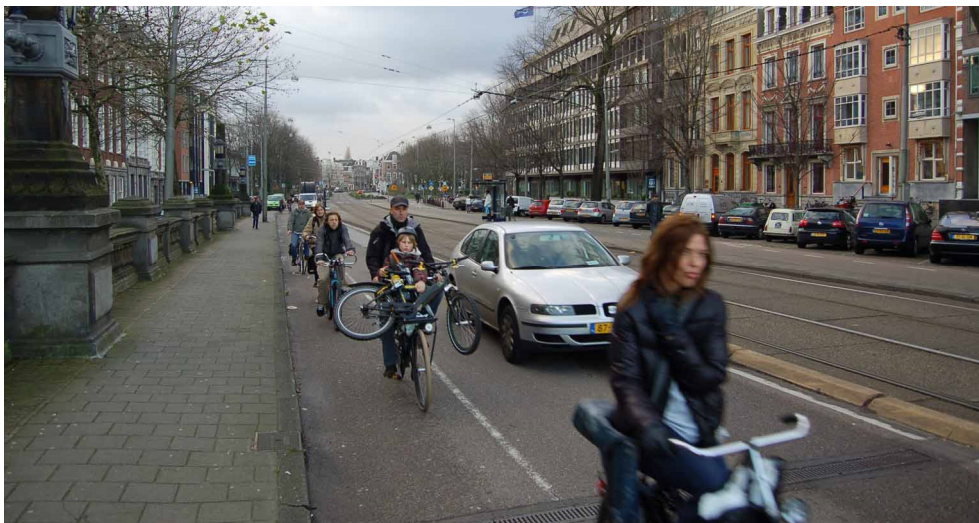
Photo 93. Segregation of traffic into separate lanes for pedestrians, bicycles, cars, and public transport in Amsterdam's Sarphatistraat. Note the fixed nature of the segregation. December 10, 2007.

A less extreme example of the outdoor static street is the segregation of traffic types into separate lanes as shown in Photo 93. The purpose of separating traffic types of different speed is to improve the efficiency of traffic as a whole. A key resource for this

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[21] Mrs. Kunte in interview with SdM on April 17, 2014.

[22] In this thesis the author refers to Form School Feng Shui, which is based on architectural and psychological phenomena, unlike for example Compass School and Nine Star Ki, which are based on astronomy, astrology, and numerology.

improvement is space. As will be discussed below, only when sufficient space is available, the luxury of separate lanes is affordable.

The Kinetic Street

As discussed earlier, the user-generated urbanism of informal settlement holds lessons of how cities form without zoning or regulation. In Kinetic City, Issues for Urban Design in South Asia, Rahul Mehrotra (2009) distinguishes the *static* city which is planned and designed by engineers, from the *kinetic* city which is of a temporary nature. The static city is the physical city as built; the kinetic city is made by the events that take place there. This distinction can also be made on street level, where the western version seems orderly and the informal chaotic.

One of the characteristics of informal settlement in South Asia is its high population density in comparison with western cities. In developed countries, known dense cities are New York City (10,500 p/km²) and Tokyo (14,000). Estimations of the density in informal settlements reach from 300,000 to over 400,000 p/km², which is more than ten times that of Cairo (31,600), world's densest city. Considering that in swelling cities often over 50% of urban population lives in informal settlements, it is clear that high densities are everywhere and that the pressure on open space is enormous.

Photo 94. Informal zoning in Dharavi's Station Road: cars, pedestrians, and vendors continuously negotiate the available space. The width of the 'lanes' is adjusted real-time. March 16, 2008.

One of the strategies for coping with such high densities is the multipurpose use of both public and private space. Successful multipurpose use has a link with informality. It is typical that most westerners who visit extreme dense areas for their first time, point at the lack of zoning in the streets. They claim that sidewalks make traffic safer, that curbs would help, as would separate lanes for handcarts. It is their planner's

mindset that physically imposed *order* is more efficient. As argued above however, zoning itself requires space. By allotting space to specific activities, that space is useless for other activities that take place at different moments in time. Only non-designated space affords permanent use, meeting needs exactly when they occur. Photo 94 shows an example of such demand driven real-time zoning. In Station Road in Dharavi, motorized traffic, pedestrians, and street vendors continuously negotiate their share of the street. When the flow of pedestrians increases during rush hour, car traffic gets jammed and vendors pull their merchandise slightly to the side.

The alternating use of space in this real-time zoning is probably the only way to deal with the high population density of urban informal settlement. Physically fixed zoning as in Photo 93 requires an amount of space that is not available in swelling cities. Note that population density in Dharavi is approximately 70 times that of Amsterdam and 125 times that of Lausanne. A version of Station Road (Photo 94) corrected for Amsterdam's population density would be 1680 m wide, i.e. it would cover all Dharavi.

There is an illustrative parallel between urban design and the design of rooms in housing. In western housing design, rooms have a specific use. Rooms are named after their *function*: bedroom, study, kitchen, living room, *et cetera*. This segregation leaves many rooms unused for most of the time, much unlike the traditional Japanese house in which the function of the room changes during the day. By changing futons and furniture, the room is adapted to what needed. The key to traditional Japanese design is the creation of an open plan. Everything can change as no element is fixed, even walls can move by means of sliding partitions. With everything moved to the side, a smooth, obstacle free floor is all that remains.

On a more detailed scale, furniture is a similar institutionalization of use. As described in chapter Furniture (page 217) the introduction of a table-cum-chairs reduces the use of a room to sitting around that table. The absence of furniture makes it possible to use a room for whatever comes up. It is this concept of an obstacle-free space that affords multipurpose use of public space. Activities and the number of people involved in them change throughout the day, as does the space occupied by them. By leaving the boundaries between activities unmarked, these boundaries can freely move to an optimum and adapt real-time.

All activities claim space, put pressure on other activities, and then allow others to take over space again. This flow in the use of space is most efficient when not hindered by physical markers such as curbs, fences, boulders, or even walls. Moreover, such street furniture items can be counterproductive in densely used areas, as they mainly split the ever-moving zones of activities rather than limit them to the intended space. In Rahul Mehrotra's terminology, the static city is at odds with the kinetic city here, whereas ideally, the static and the kinetic city are in harmony.

Photo 95. On Friday afternoon, half of Dharavi's 90 Feet Road is used as a mosque. April 19, 2013.

Photo 96. The same road only a few minutes later. April 19, 2013.

Especially fences on curbs show how informal forces backfire on the intentions of planners and urban designers (Photo 97 and Photo 98). Such fences are designed to keep pedestrians on the sidewalk and to reserve the road for motor vehicle traffic. The sidewalk however is also the realm of shopkeepers, street vendors, and their customers. Because of the crowding, non-customers prefer to walk on the other side of the fence. Once there, it is hard to return to the sidewalk, making the whole scene less safe than without the fence.

Photo 97. The static city hindering the kinetic: The fence on the curb inhibits pedestrians returning to the sidewalk. Sion Mumbai, March 13, 2008.

Photo 98.The static city hindering the kinetic: Passengers at this bus stop have to wait at the traffic side of the fence; otherwise, they cannot enter the bus. Sion Mumbai, March 12, 2008.

In addition, street vendors see this parallel flow of pedestrians as potential clientele, so the vendors also move to the roadside of the fence (Photo 99). Moreover, the fence provides a nice backing. This creates a second lane of vending activities, reinstalling the informal multipurpose use of space, squeezing the vehicle traffic space even further than without the fence. In an attempt to make the fence (i.e. zoning) effective, authorities have declared street vending illegal. Police officers have a tough job enforcing this ban as they are highly outnumbered by their targets. As soon as a raid starts, the news spreads like wildfire. Vendors pick up their merchandise quickly and hide it behind a tree, a lamppost, in the subway or even in the shop of a friend legal

shopkeeper. Some ten minutes later, when the police have left the unlikely empty street, business goes back to normal.

Photo 99. Kinetic zoning adapting to static zoning. Street vendors use the fence as backing, knowing the traffic on that side that brings customers. Mira Road, February 6, 2010.

The issue here is the density of people. Of course zoning and planning do work, as long as capacities meet the numbers. When congestion occurs, people start looking for shortcuts and challenge the planned zoning and formality as a whole. Shortly the cure (zoning) becomes worse than the disease, especially with zoning embedded in physical objects. As we have seen, physically manifested zoning of use is space consuming and for that reason problematic when dealing with hyper density. The kinetic city is much a live thing, as it is capable of permanently adapting itself to the context. This ongoing adaptation marks the efficiency of user-generated zoning in informal settlement. In fact, the difference between formal zoning and user generated zoning is the use of time, the use of the fourth dimension. It is what affords 24/7 use of space.

New urban planning strategies could give a significant role to informality, help overcome the limitations of 20th century urban planning, and enter the realm of Post-Cartesianism. An invitation to learn from informal urbanism was sent by Alfredo Brillembourg and Hubert Klumpner in the documentary *Caracas, The Informal City* (Schröder, 2010). Klumpner says about Caracas: "But why do I feel as a European that this city is a total chaos? I think it is a typical response. There is a myth that the city is ordered and that myth exists in city halls around the world. The reality is however, that the city has always been chaotic. In Caracas all these forces stream freely and have produced new forms of city that are not known to us."

Summary

The myriads of alleys so emblematic of urban informal settlement have their origin in hamlets in the countryside. The human scale of these alleys is typical of vernacular environments, which fits with the notion that informal settlement in cities is a vernacular urbanism found where the planned city fails to deliver sufficient housing. A second marker of this vernacular urbanism is the kinetic use of space. The spatial segregation of traffic typical of the planned city, does not afford the efficient use of space found in informal zoning. Human activity thus is the key to how the dense informal city can exist.
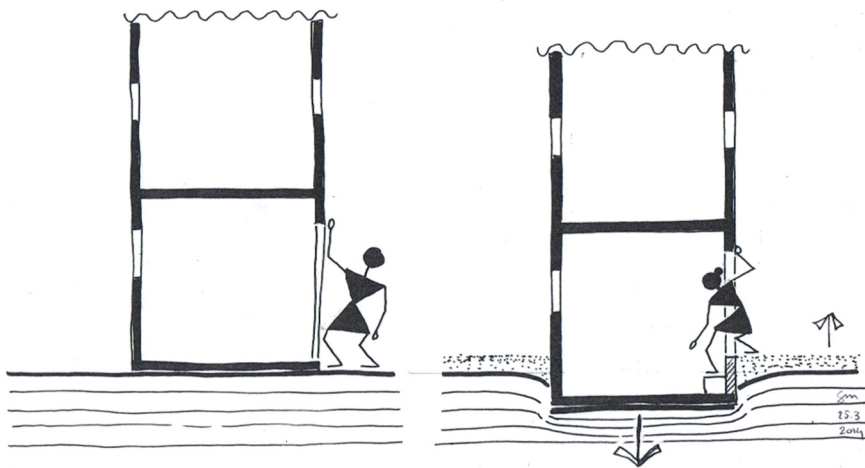
Level

Informal settlement often sits on land less suitable for building. Many of the *barrios* and *favelas* in South-America for example, sit on slopes that are too steep for safe construction, due to the risk of landslides. Living on the bottom of a valley can be risky too, as it is where heavy rains accumulate in floods and mud streams ravage whole neighborhoods. Dharavi sits on land that is as flat as a pancake and seems not particularly vulnerable to such natural disaster. The peaceful look of this flatness however, is deceiving. Although slowly, floor- and street levels are constantly changing, and the dynamics of these levels are visible in Dharavi's architecture. In this chapter, floor levels are the telltales of geological and archaeological dynamics.

Photo 100. The house in the middle gradually disappears behind the rising street level. Both neighbors just keep up, while the higher buildings at both ends of the photo are ahead in the race. This part of Dharavi Main Road summarizes the phenomena mentioned in this chapter. December 28, 2012.

Initially, Bombay was one of the seven islands that over the centuries were connected by dams and land reclamations. Today they form one landmass. Its proximity to Mahim creek, where the Mithi River empties into the Arabian Sea, determines Dharavi's geology. Until the late 19th century, Dharavi was mainly mangrove swamp in a brackish estuary. The area gradually got filled in with natural and human waste, affording the creation of settlements (Jacobson, 2007). In the mid-twentieth century, the city of Bombay reached no further north than Sion. In the 1950s and 1960s, although Deonar (further up north) was the designated dumping ground, Bombay contractors knew they could save time and money by emptying their loads in the swamps of Dharavi, which eventually turned them into a landfill (Sharma, 2000). Consequently, the land of Dharavi is on former marshes and its underground contains peat-like layers of organic material. As such, soil is soft and compactable, it has a limited load bearing capacity, and consequently, heavy buildings tend to sink.

Besides that, the levelness and flatness of the land makes it vulnerable to flooding, as excessive rainwater has no lower area to flow to. In order to keep a building dry, the level of its ground floor must be higher than the level of the surrounding land. Although this is a commonly known principle, making it work for the longer term is difficult due to the sinking of buildings into Dharavi's soft soil. Following the pattern of 'incremental development', buildings become gradually better, higher, bigger. People extend their houses with another storey; materials that are more permanent replace light wooden panels. Such improvements however make buildings heavier, if not too heavy.

Drawing 16. Buildings sink into the compactable soil, while the street level rises. Consequently, a higher threshold is needed.

Meanwhile, the grounds around buildings, i.e. streets and alleys, move in the opposite direction; they rise. The continuous addition of dirt, gravel, stones, and bricks gradually raises their level. Every paving and filling of potholes comes with again more material. Consequently, it puts the floors of adjacent buildings on a lower level. The speed by which the land is rising is considerable. A temporary pit for works on an underground main water pipeline in Mahatma Gandhi Road, showed remains of floors on a level 1,5 meter below today's main ground floor level. Digging the pit brought up sand, dirt, stones of approximately one inch as well as stones very similar to those found on the Sion – Matunga railway track (!). The walls of the pit showed a layered structure. Another dugout on a construction site north of 90-Feet-road revealed an archaeological package of nearly two meters thick on top of the natural underground (Photo 101).

Photo 101. On this site near 90-Feet Road, today's ground level is almost two meters (red arrows) above the natural underground. April 10, 2013.

Bearing in mind this area is inhabited since half a century, the ground level rises with an average speed of more than one inch per year. So if not the buildings are sinking, the surrounding terrain is rising and eventually lies higher than floor level. From then on, a building is prone to flooding. The easiest fix is a higher threshold, but as the rising of the terrain does not stop, the threshold has to be heightened repeatedly. It is not uncommon to find houses with a floor level more than a foot below street level.

Demolition and Debris

Improvement of shacks and buildings often means partial and sometimes full replacement. Most structures lack provisions for future extension, since investing in such provisions is too risky. Lack of security of tenure is one of the issues as potential eviction turns an investment into an almost certain loss. Secondly, as De Soto (2000) says, investment and depreciation are less common in the informal economy than in economies with strong property systems. As a result, new buildings are often paid for with saved capital, and less used as collateral for loans. Thirdly, this practice of minimal investment affects the physical quality of the built structure. Durability of materials and techniques is of lesser importance than everyday needs. Masonry looks fine after completion, but degrades rapidly due to unequal sinking or long-lasting exposure to water. Summarizing, built structures are often not made for future extension and replacement is a common form of improvement.

This practice of replacing buildings rather than extending them with another story that seems at odds with the idea of 'incremental development' mostly thought of as a

process of accretion. However, replacing a whole house still works piece-meal on a neighborhood scale as it respects the present social structures, preserves the local social, physical, and economic context, and thus generates the incremental city. Alexander argues in (2002c) that among the properties that make things alive, there is the property of the void. It serves as a contrast to the presence of things, and gives room to new life. Christopher Alexander (2002d) argues that one of the properties of the process of creating life is its preserving the existing structure. The resulting process is one of an unfolding pattern, in which parts also disappear. Incremental development therefore is comparable to a forest, in which individual trees die, while the forest as a whole is alive and keeps growing.

When a building is demolished for replacement, the brick and concrete debris is deliberately left on the site. First, it simply saves time and effort. Second, trucks often cannot reach the site, which makes transportation a costly business. Third, by keeping the debris, the level of the new to build ground floor will be higher, which is the most effective way of keeping up with the raising levels and creating a dry building.

The Raise Race

Street level and ground floor level are thus in a continuous race. Streets rise gradually and buildings make a step upwards every time they are redeveloped. Buildings among each other are in a similar race. The higher a building's ground floor level, the more often it has been redeveloped, as demonstrated in Drawing 17. In addition, the more multi-storied a building, the more often it has been redeveloped, and the higher again the ground floor level.
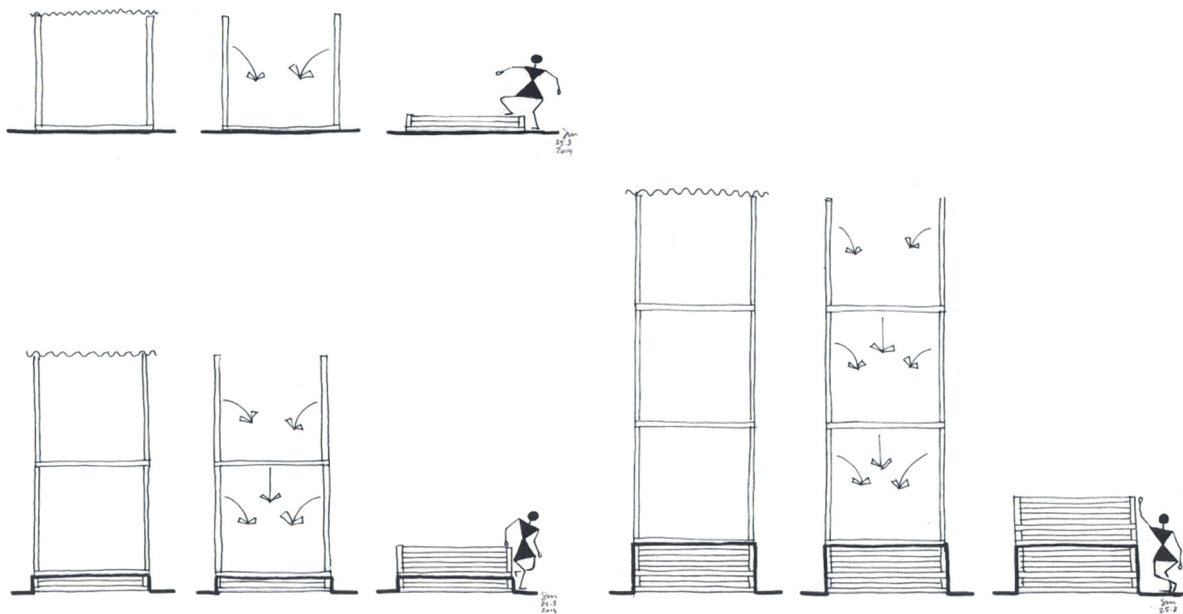
Drawing 17. When consecutive redevelopments consist of ever more stories, the debris packages they leave behind get thicker. The third package is thicker than the first and second combined.

In addition to this accretive effect of the regeneration cycle, there is another incremental effect. Since the next generation of a building has more stories, every next demolition will consequently leave more debris than the previous, as is shown in Drawing 17. Successive debris packages under the ground floor are therefore of increasing thickness, at an exponential rate.

Photo 102. The higher building sits on a higher base and has its first floor level half a story higher than the building on the left. December 21, 2012.

In narrow alleys with limited upward view, one can simply predict the height of a building by looking at the level of the ground floor: the higher the floor, the higher the building. Moreover, as the floor level relates to the number of redevelopments, it is also an indicator of the owner's wealth.

The upward race of buildings and streets has its losers too: some buildings cannot keep up with the others and find themselves a foot or more below the surrounding level as seen in Photo 100. Keeping such places dry during monsoon is of course a challenge. Curbs keep water, dirt, and mud away from the entrance (). Puddles and potholes in front of doors are filled, adding again to the street level. Thresholds are heightened in order to stay ahead of the rising street level, consequently lowering the doorway.

Photo 103. Raised terraces and thresholds will keep the water out during monsoon. The counters 'sink' behind them. The barbershop on the far left uses a one-foot board. January 19, 2013.

Photo 104. Heightened thresholds keep the water out, but lower the doorway. April 19, 2013.

Photo 105. Street level reaches halfway the ground floor story. January 21, 2013.

These dynamics of levels have typical architectural consequences. On one end, the older buildings look smaller as they seem sunken into the ground and one enters through a low doorway, stepping down into a surprisingly high room (Drawing 18). On the other end, the high ground floors of tall buildings create the effect of a stage, giving

shops and teahouses some grandeur (Photo 106). Steps in front of a house afford outside seating, a pleasant extension of the home (Photo 107).
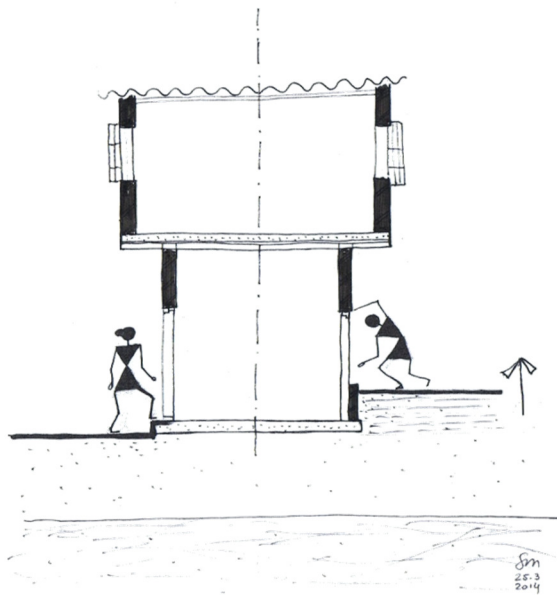
Drawing 18. Long time ago versus today: entering a surprisingly high room through a low door due to the changing levels.

Photo 106. The terrace of the tailor shop is a welcoming gesture. The higher terrace of the teashop gives even more exposure to the mess-tin, thus advertising the teashop. January 17, 2013.

Note that, as lower houses are more prone to flooding and subsequent damage, the costs of repairs will eat people's savings and hinder investment in replacement. In higher buildings however, less money is lost on repairs and loss of turnover since ground floor economic activities can continue during monsoon. Thus, a building in

which occupants have invested much will support those occupants better. This illustrates the symbiosis model in which building and people support each other. A lower (i.e. less sturdy) building weakens its occupants.

Photo 107. The steps and stages are more than only a practical necessity. They afford sitting and socializing. Communal and private space blend smoothly. Photos SdM, January 17, 2013.

Photo 108. Cleaning the alleys with water is part of the daily routine. Steps keep items dry. January 16, 2013.

Photo 109. Raised floor levels show results of negotiation. The concrete steps making a turn allow the stairs to come down without landing too much on the neighbor's doorstep. Future redevelopment of the house on the left and its subsequent steps will not hinder the existing. January 17, 2013.

In 2009, Mumbai municipality started paving many of the roads in Dharavi. This *pucca*fication has certainly slowed down the dynamic of the street level. Part of that dynamic is the sweeping people do in front of their home, displacing the dirt making the road. The sealed roads now keep the level fixed.

Summary

The theme of 'Level' shows that landscape is part of the symbiosis. In the vernacular environment of Dharavi, people deal with level in a direct way, visible in the buildings. In the planned city, level is part of infrastructure and civil engineering and therefore less visible in the architecture of homes. Contrary to vernacular, managing levels is outsourced to the professionals of the planned city.

Roof

Photo 110. The purpose of a roof is to protect people against the sun and provide shelter from the rain. Salt pans Mira Bhayandar, February 6, 2010.

The roof is emblematic of the main purpose of the house, i.e. providing shelter to its occupants. This chapter investigates what the roof can tell us about the change from traditional to modern architecture. It will inevitably lead us along informal settlement and explain why its roofs look like they do.

From *Kacca* to *Pucca*

As we have seen earlier, *kacca* roofs are made of readily available material. In the forests and the jungle, roofs are therefore built of trees, branches, and leaves. The wood is used for structures, whereas the leaves are used as cover. Just like in a tree, the wood bears the foliage that provides shade and shelter. Thatched roofs, with reed or grass, follow the same pattern. By stacking leaves the same way as roof tiles, rainwater is directed away from the interior until it finally falls from the roof's edge. Leaves and grasses are of course prone to rot and insects, which is why they are replaced with roof tiles. The introduction of roof tiles is similar to the introduction of bricks as described in the chapter about *Kacca* and *Pucca*. Like bricks, roof tiles are made of baked clay and can be produced in the region, if not locally. More than bricks, roof tiles are a major step in the process of *pucca*fication, since the roof also protects the walls. Provided the eaves are of sufficient size, a *pucca* roof will extend the life of *kacca* walls. The typology of a wooden structure bearing a thatched or tiled roof is found in vernacular architecture all over the world.

A major change in the design of roofs came with the introduction of corrugated asbestos-cement sheets. These sheets are rigid, durable, and cover a much bigger area than a roof tile. The support structure therefore can be of simpler design, often no more than horizontal steel pipes spanning from sidewall to sidewall, at sheet-length intervals.
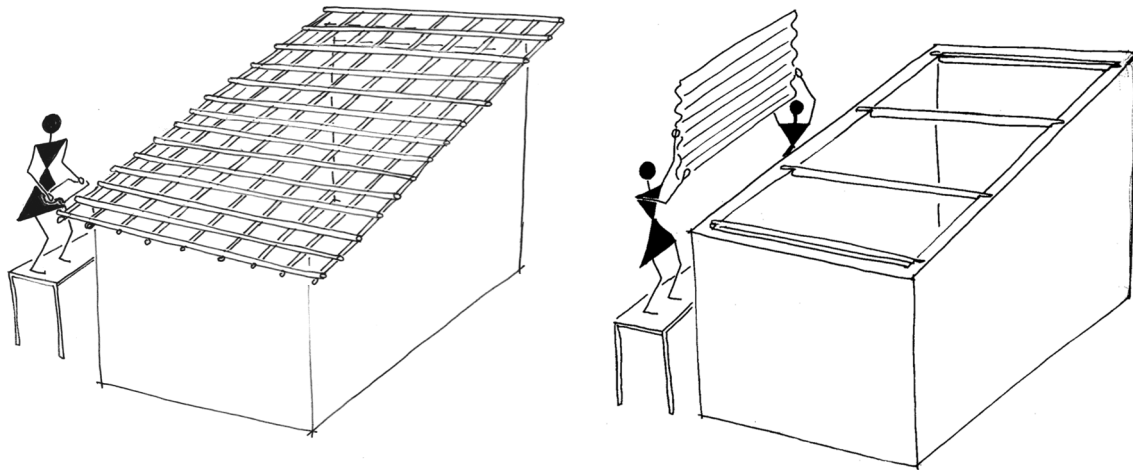
Drawing 19. Roof tiles require an elaborate support structure, whereas asbestos-cement sheets require only a few beams.

The production of asbestos and corrugated sheets requires techniques that are only available on industrial scale. In vernacular environments with a convivial economy, asbestos-cement sheets have little place, but in commodity driven environments they are definitely the winner since they afford the cheapest way of building. Material advantages are their rigidity, durability, and compatibility with cement mortar masonry. Asbestos-cement does not rust, is easily secured, and is fireproof. During monsoon, the asbestos cement sheets have the advantage of being less noisy than corrugated steel sheets. They do not gust in the wind, unlike sheets of tarpaulin.

Slum Roofs

Pavement dwellings in their most basic form have a roof made of readily available materials, such as plastic sheets and tarpaulins, covering a rope-tied structure of sticks, tubes, and planks. It is the city's equivalent of the jungle roof made of branches and leaves. Pavement dwellings of more permanent character are covered with asbestos-cement sheets. The same goes for settled dwellings in slum areas. In general, one can say that a typical urban informal dwelling has a roof of corrugated asbestos-cement sheets. This roof type is a distinctive marker by which informal settlement can be spotted in aerial photos.

Photo 111. Blue tarpaulins fixed on top of asbestos cement sheets, in order to improve water tightness. January 26, 2010.

The use of asbestos-cement roofing is not at all limited to informal settlement. It is also used on detached houses in well-to-do neighborhoods.

In both traditional building and urban informal settlement, one finds roofs covered with a second layer of materials. Tarpaulins and plastic sheets improve water tightness (Photo 111). These sheets are kept in place with whatever available heavy objects, even roof tiles (Photo 112 and Photo 119).

Photo 112. Blue tarpaulins however disintegrate under sunlight. January 25, 2010.

Loft

Vernacular houses are often equipped with an additional floor used for storage. Far from the ground and out of the reach of water and animals, the loft is a good place to store food. To avoid the buildup of moist, a loft must be ventilated. A roof covered with roof tiles is indeed permeable for wind. This permanent ventilation affords drying all kinds of fruits and vegetables while at the same time it takes out the heat that builds up under the roof. The loft thus becomes an instrument for food preservation. The presence of a loft has an important positive effect on the climate in the ground floor rooms, since the loft floor blocks the heat radiation that comes from the roof. The next two paragraphs will elaborate on this.

Photo 113. A traditional house in Pundhe, consisting of a ground floor cum loft. The grills under the eaves afford cross ventilation through the loft. November 8, 2012.

The physics of the Drying Loft

The loft's drying system is a combination of ventilation and the principle that hot air can hold more water than cold air can. The system runs on solar energy as shown in Drawing 20. Solar radiation heats the roof tiles (1), which conduct and transfer the heat to the air entering the loft (2). Heating up the air results in a lower relative humidity, effectively making the air dryer (3). This dry air takes water from the stored fruits and vegetables (4). Permanent natural ventilation then drives the warm air out, and the water with it (5). The incoming and replacing air goes through the same cycle.
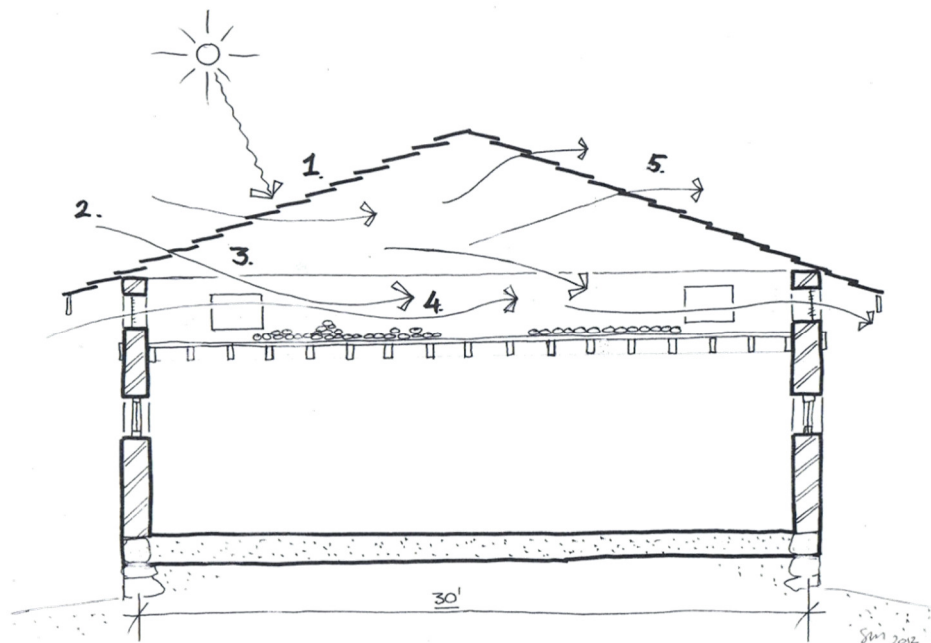
Drawing 20. Food preservation in a loft: drying by means of natural ventilation and solar energy.

At night, the roof loses heat rapidly through radiation into the dark sky, and consequently becomes the coldest part of the loft. Moist in the loft air will condensate on the underside of the roof tiles and resulting drops will run down and out, following the stacking of the tiles. Note that both the day and the night system help drying the food and that both require a permeable roof structure: during the day the tiles afford ventilation, at night, they channel out condensation.

Photo 114. Onions drying in the loft. Interior of the house in Photo 113. November 8, 2012.

The Loft as a Heat Shield
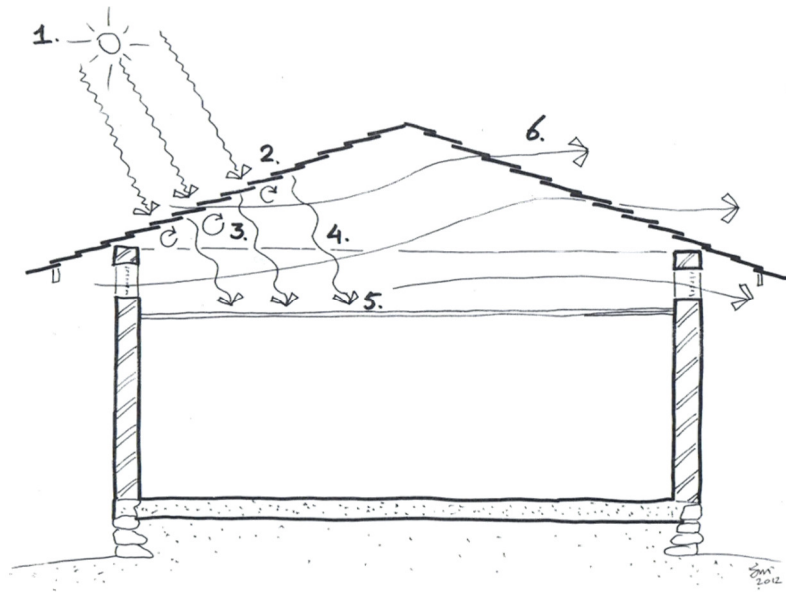
Drawing 21. Reduction of heat radiation by a loft. Solar radiation (1) is visible light, whereas the heat from the roof (4) is infrared light, which is easier to shield off. Thus, the room below the loft floor remains cool.

Photo 115.A tiled roof has an open structure affording natural ventilation. Interior of the house in Photo 113. November 8, 2012.

As we know from thermodynamics, every object with a temperature above the absolute zero radiates heat. The higher the temperature of the object, the more intense the radiation it emits, as illustrated by Drawing 21. A roof exposed to the sun's radiation (1)

will heat up both the roof (2) and the air under it (3), carried out by natural ventilation (6). The hot roof acts as a radiator (4), although less intense and at a much longer wavelength than the sun.[23] When under such an exposed roof, one can sense this radiation and perceive the room much hotter than one would expect from reading the thermometer. A thermometer only shows air temperature, not radiation. As for comfort, temperature and radiation add up and can compensate each other's absence, for example, when one enjoys sunshine in a freezing cold environment. In a similar way, the presence of a hot roof generates the sensation of high temperature and shielding the room from the radiating hot roof is an effective way to improve comfort. The loft floor is such a shield and even a mezzanine does the trick. In fact, the floor (5) serves as a parasol against the radiation coming from the roof. Temperatures measured in a room[24] with a mezzanine showed a gradient of three degrees in air temperature although the air above and under it could circulate freely. This is illustrated in Drawing 22 and Diagram 8.
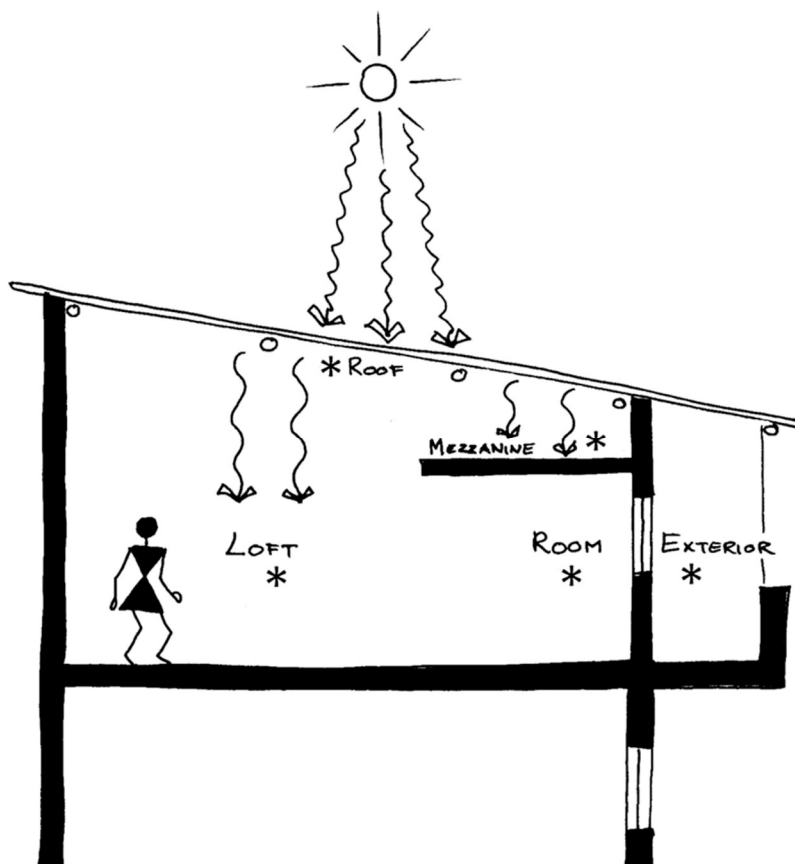
Drawing 22. Temperature measuring points (asterisks). Results are shown in Diagram 8.

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[23] The sun is a source with a temperature of 5500°C, whereas the roof is approximately 60°C highest.

[24] House of the Devare family in Vasind, India, 18 December 2012.
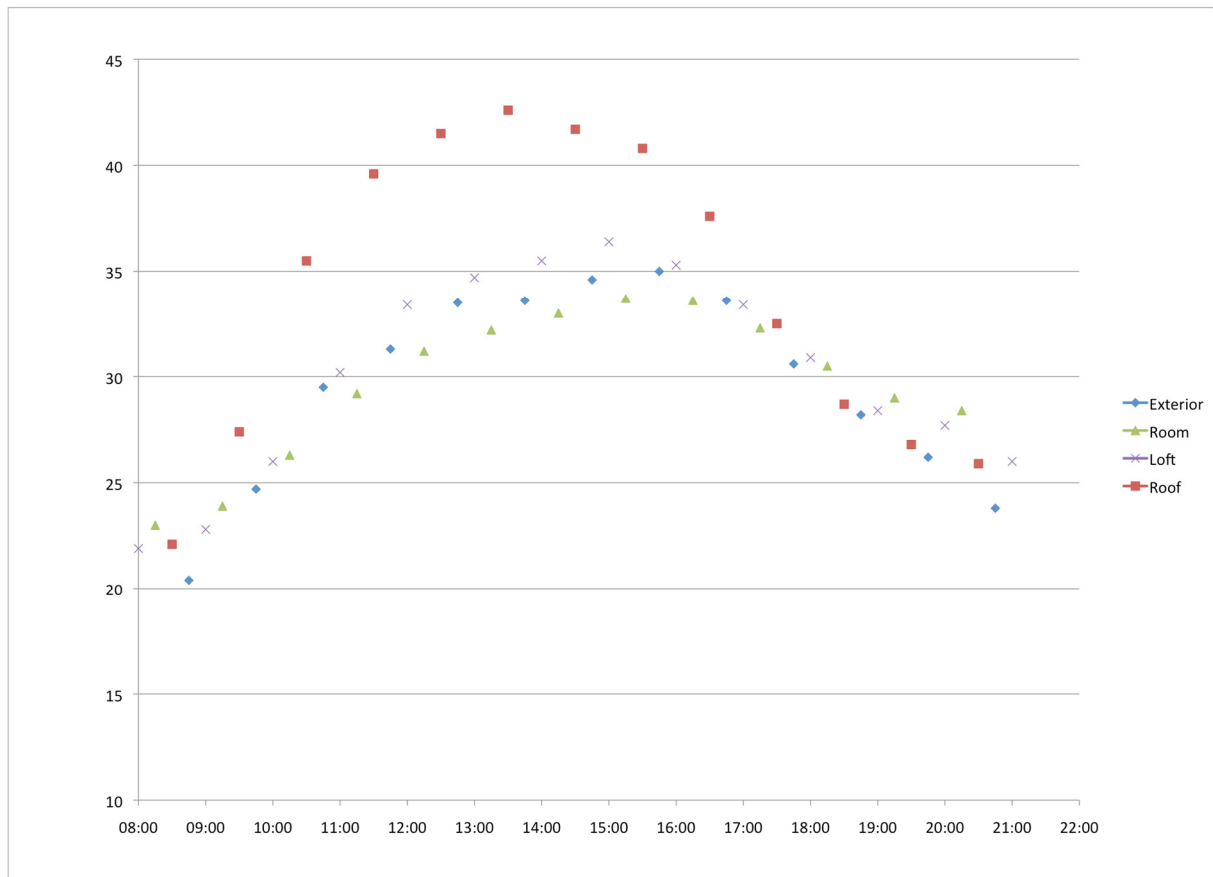
Diagram 8. Although there is an open connection between the Loft and the Room, the difference in temperature is significant. The temperature under the mezzanine (Room) is less influenced by the Roof than the temperature of the Loft is.

Since asbestos-cement sheets are dense and thin, they provide little thermal insulation, and come with considerable heat buildup under the roof [25]. In order to tackle this problem, some put a layer of hay or grass on top of the sheets. This layer is a micro version of the loft system, i.e. it casts shadow on the actual roof, thus reducing the temperature. Ceramic roof tiles are thicker and less dense than asbestos-cement sheets, which makes them less heat conductive. Another downside of asbestos-cement roofing is its impermeability for wind. Due to the size of the sheets, a sheet-clad roof has only few joints compared to a tiled roof. Moreover, the joints themselves are tight and afford no ventilation. Since ventilation is crucial in the heat management of the roof, as explained above, an asbestos-cement roof is a heat trap. In informal settlement, this situation is worsened by the general lack of ventilation. As is visible in Photo 119, few dwellings have windows to the open and therefore cannot benefit from cross ventilation.

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[25] In the same house we found temperatures of 43˚C directly under the roof, whereas the ambient temperature was about 10 degrees lower.

Photo 116. The tin roof over the roof terrace is a modern version of the heat-shield loft. Vasind July 12, 2014.

Multi-storied apartments with a covered communal roof terrace as in Photo 116 enjoy the advantage of a ventilated loft. The thin roof over the terrace protects the top floor apartments from the sun, and affords for example laundry drying all year round.

Applications

Photo 117. Plastic items are lightweight and bulky. In Dharavi's Thirteenth Compound recyclables are processed on the ground, while stock is kept on the roof. November 6, 2010.

The loft thus serves more purposes than storage alone and is a characteristic component of the vernacular dwelling. Lofts are also found in pavement dwellings, as described in that chapter. Whereas the loft in rural architecture mainly serves storage,

the high demand for floor space in the city makes people live and work in lofts as well, and even sleep there. Storage space is found on top of the roof too, as in Photo 117. Sometimes people sleep on the roof, e.g. on the bright colored mats in Photo 119.

One of the aspects that make life in high densities less comfortable is this moving into spaces that are more suitable for storage than for living. As we have seen in the paragraphs on physics, the loft would ideally serve as cavity space or for preserving food. The encroachment of living space into the cavity space is where densification goes at the cost of comfort. In order to keep the comfort, it is therefore important to keep a cavity structure, however small, over the top floor room. A mezzanine floor just below the roof as in Photo 118 does this job as well.

Photo 118. A mezzanine floor in a workshop blocks heat radiation and provides storage space. Dharavi, April 8, 2013.

Asbestos is a known threat to health; still it is commonly used in corrugated fiber cement sheets. Renovation and demolition of old asbestos cement roofs is considered one of the primary exposures to asbestos in India (Subramanian & Madhavan, 2005). The awareness of its risks is low, since the effects manifest themselves decades after exposure, in some cases after more than 40 years. Intact, asbestos-cement locks in harmful fibers, but like any construction material, the sheets will eventually erode and

let go of the fibers. Since 1960, India's construction industry has used some 7 million tons of asbestos. The scale of the health problems is not clear yet, although effects are already apparent (Burki, 2010). Improvements on asbestos-cement roofs should therefore be made with the least possible use of power tools and should aim at reducing erosion and use of the sheets altogether.

Concrete, cement, and corrugation. The flipside of strength.

An important marker of the phenomenon of *puccafication* is the use of cement and techniques that make buildings tough.

Corrugated asbestos cement fiber sheets get their strength from the basic principle of reinforced concrete: combining the pressure resistance of cement with the pull strength of another material (i.e. steel bars or asbestos fibers). In a simpler form, the principle is also used in plasterboard: the gypsum core takes pressure, whereas the paper cover takes pulling forces.
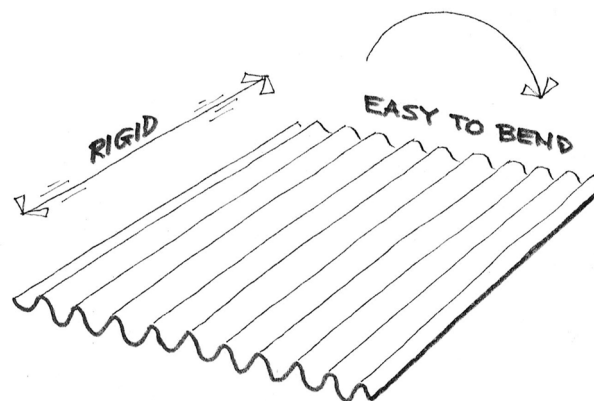
Drawing 23. Corrugation gives steel sheets their distinct structural properties.

A second strengthening factor is the corrugation, also known from its use in steel sheets. Corrugated steel is perhaps the most iconic of all building materials used in squatter settlements. It is a versatile product as it is strong, watertight, easy to cut, and above all very cheap. It all starts with a sheet with a thickness of only a few millimetres. Such a sheet can be bent or folded in any direction, as a flat sheet has limited stiffness. It is the corrugation which adds the typical structural character. A corrugated steel plate can easily bend in one direction, whereas at the same time it is very rigid in the other.

The production of steel plate is straightforward. Solidified steel bars are rolled until they have the required thickness. Cutting is as easy as cutting paper. Next is corrugation, done by the most basic of all machines. Let's say that a classic machine has gear wheels. A corrugation machine would consist of two gear wheels only, nothing more than that. Turning one wheel will automatically turn the other wheel. By feeding a flat steel plate between the two wheels, a regularly corrugated steel plate will appear on the other side of the wheels. Asbestos-cement sheets are cast in a corrugated mould.

The resulting wave form sheets are ready for roofing. Due to their stiffness the sheets need limited structural support (as explained in the chapter about Roofs). Much like ceramic roof tiles, a limited overlap of sheets will result in a watertight roof. The wave pattern offers an effective interlock along the edges of the sheets. The corrugation prevents leakage to the sides of the sheets.
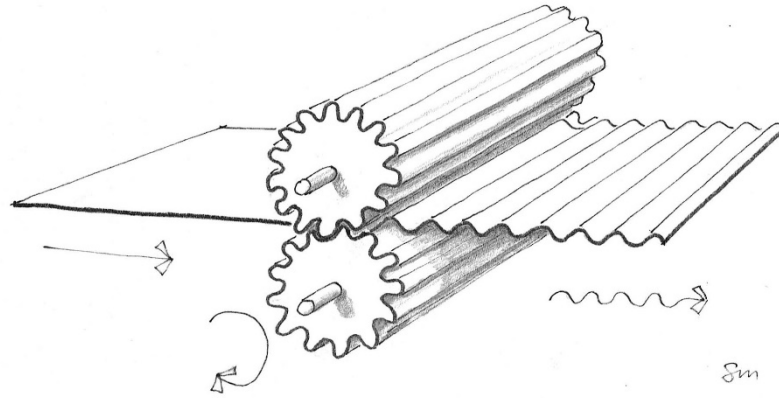
Drawing 24. Rolling a corrugated steel sheet.

The resulting structure is strong and light weight. It performs very well on the strength to material ratio. This is however also the cause of its poor performance on heat insulation. Its lack of material volume comes with a lack of heat accumulation capacity. Both roof sheets and concrete walls are saturated with heat rapidly and therefore reach higher temperatures than heavier, i.e. more voluminous, structures. Since they reach higher temperatures, they radiate heat, which is detrimental to the interior comfort. The poorer thermal performance of *pucca* materials therefore comes from their strength, their toughness.

When it comes to improving living conditions and comfort on the top floor of urban informal dwellings, a space-efficient and durable option is laying roof tiles on top of existing asbestos-cement sheets, as in Photo 119 and Photo 120. It creates a cavity with natural ventilation and slows down the erosion of the underlying asbestos-cement sheet. Moreover, roof tiles can be laid without damaging the sheets.

Summarizing it can be said that the thinness, strength, and rigidity of asbestos-cement sheets are advantages; they keep the product cheap and require little support structure. Disadvantages are its threat to health, poor insulation, and big size; the large sheets leave fewer ventilating joints. It shows here that the material advantages, i.e. money aspects, prevail over human qualities (comfort and health). In a *kacca* situation, the cheapest way to make roofs more *pucca* is to apply asbestos –cement. All other options are more expensive. Additions like tarpaulins and roof tiles are attempts to counter the poor thermal performance of asbestos-cement. Since almost all roofs in informal settlement are made of asbestos-cement, one might expect a fairly uniform and neat outlook of the roofscape. That is however not the image many have of informal

settlement. The roofscape is a patchwork of additional materials (Photo 119). The measures people take against the poor comfort generate the 'messiness' of the roofs. As weird as it may sound, this messiness is actually the signature of improvement, since without it, the roofs provide less comfort.

Photo 119. Asbestos-cement roofs covered with tarpaulins and roof tiles for additional waterproofing. The use of roof tiles on top of corrugated sheets, like on the house in the front, is a durable improvement of heat insulation, and slows down the spreading of asbestos fibers. Dharavi, January 26, 2010.

Photo 120. An asbestos-cement roof partly covered with roof tiles. Worli koliwada, April 7, 2013.

The use of corrugated asbestos-cement sheets as roofing material is primarily emblematic of the penetration of the market economy in construction practice, and consequently for urban informal settlement. Perhaps traditional vernacular and high-style architecture are the only sectors where it is barely used. Traditional vernacular is (by definition) not susceptive to market effects, and therefore hard to penetrate with mass production. In high-style architecture, the cheap connotation of corrugated sheets makes them hard to apply. Corrugated steel and fiber-cement are used almost everywhere else: in informal settlement, in *pucca* private housing, in cheap mass housing, in industrial buildings, et cetera. The widespread use of asbestos-cement in informal settlement is caused by the fact that it is the cheapest *supplied* construction commodity in the city. Only recycled waste materials are available for less, but given their low durability, in urban informal settlement they are soon replaced.

Photo 121. Modernization in Susant village in Bihar. Concrete columns and slabs replace the traditional pitched roofs of wood and rice thatch. August 2, 2014.

Not all modernization comes with asbestos-cement roofs though. The use of the system of concrete columns and slabs is a common practice in making *kacca* houses more *pucca*. As a result, many a roof consists of a concrete slab, which allows future extension with another story. The concrete slab has similar heat issues as the asbestos-cement roof, although it has the advantage of being watertight. This water tightness is what affords the construction of flat roofs, whereas *kacca* materials are only suitable for pitched roofs. A flat roof affords use as a terrace and consequently as a place to sleep (Photo 122). Sleeping outside is common in tropical climates. In this case however, one enjoys the safety of a private space whereas sleeping in a veranda is more like sleeping in public. It is for this reason that women usually sleep inside, and only men and boys sleep outside. A well-protected roof terrace affords women to sleep

outside too. Sometimes sleeping outside is a necessity, as more than the old *kacca* house used to do, the *pucca* structure of the house tends to keep the heat inside. As is discussed in detail on page 169, the concrete flat roof is an important element in urban social life, since it provides solace for the loss of the veranda.

Photo 122. The concrete roof of the *pucca* house affords comfortable outdoor sleeping, whereas the same concrete slab traps the heat of the day inside. The interior climate of *kacca* houses (on the right) is generally better. August 2, 2014.

Photo 123. A familiar sight in early monsoon: men fitting plastic sheet over an asbestos-cement roof in Dharavi. July 11, 2014.

Photo 124. Walls are not always watertight either. The use of tarpaulins is so widespread it turns whole neighborhoods blue. Note the tiled roofs in the foreground, which do not need plastic sheets once they are entirely covered. Asalpha, Mumbai, July 20, 2014.

The test of a roof is in exposing it to monsoon and indeed many roofs fail to pass that test successfully. Even the supposedly watertight asbestos-cement roof has some weak points. Problematic are the bolts with which the sheets are fixed to the support structure. Since the bolts penetrate the sheets, it all depends on the quality of the sealing around the bolts, and even high quality sealing does not last long in the tropical sun. Joints between sheets tend to leak as well, especially when the roof is not steep enough. As a result, in early monsoon many a person can be seen fitting additional waterproofing in the form of plastic tarpaulins.

Summary

The messiness of the typical slum roof is emblematic of the struggle people face when they move from a vernacular environment to a place controlled by industrial production. In vernacular architecture, materials and techniques fit like a hand in a glove. Maintenance, repair, and improvement are part of the daily routine and blend invisibly with the existing. In today's industrialized architecture, multiple building systems are combined in an encompassing design. Much of design and engineering is about fitting different systems together. Improvisation marks the informal world that lies between vernacular and modern systems.

The corrugated asbestos-cement roof is mostly chosen because it is the cheapest option people have. When an asbestos roof is leaking, there is no way to repair it with the same material, since the cause of the leakage is not in the material but in the way it

is applied. Adequate repair would require a complete overhaul. A vernacular thatch roof however, allows local addition of thatch or partial replacement. The repairs found in informal settlement are a combination of the vernacular approach, i.e. repairs in a daily routine manner, with materials that are not part of the asbestos-cement system. The repairs therefore do not blend with the existing as they do in vernacular architecture. The messy roof is a manifestation of ordinary people's attempts to cope with materials that only afford use in professional building systems.

The loft is a key element in keeping the interior climate of a house comfortable. The loft as such is not intended as living space and is ideal for storage. In informal settlement however, there are two motivators for people to inhabit the lofts. First, the demand for living space is so high that people eventually occupy whatever space is available. Second, the need for storage space is less, since the market provides a daily supply of food. There is no need to keep large stocks of rice, vegetables, and fruit in the urban household. Note that both these motivators come from supply-driven market mechanisms.

Apparently, the transition from vernacular to modern goes through a stage of forced mixed use of space and forced combinations of materials. The mismatches that inevitably come with it are visible in the form of poor comfort and messy appearance. The roofs of informal settlement are emblematic of this struggle.

Stairs

Stairs and ladders are prominently present in Dharavi's architecture. Unlike in high-style urban architecture, one can find stairs in front of almost every informal house. The purpose of stairs of course, is to provide access from one floor to another, but a closer look shows that many aspects of living in informal settlement can be recognized in how these stairs are made and positioned. This chapter investigates the technical details of Dharavi's stairs, how they function in daily practice, to what extent neighbors share them, and what typical informality-issues they reveal.

What We See

Prominent are the stairs on the ground floor, most of them built outside. If at all built inside, they are often directly accessible from the street, as in Photo 125. Stairs on upper floors are mostly not visible from outside. Stairs in Dharavi are steep and in fact are ladders. Their steps however, are too generous for ladders so stair-ladders would be the more appropriate name. To be exact, stairs are composed of steps whereas a ladder is made of bars. Moreover, a ladder is steeper than 15 degrees from vertical. What we see here is something between easy ladders and steep stairs. The steps are comfortably broad; the beams however, are almost vertical. In this chapter, they are called stairs because they are permanently mounted and are composed of steps and thus have mostly the characteristics of stairs.

Photo 125. In Worli Koliwada, stairs sit inside the volume of the house and are part of the facade. January 10, 2013.

Photo 126. The white sheet prevents the spread of shoe dirt over the teashop. January 3, 2013.

Photo 127. Stairs going up to a tailor workshop. The back of the stairs is closed off to prevent snippets of textile littering the shop below. November 19, 2012.

Outside stairs not only connect ground floor and first floor, they also connect the exterior with the interior. Typically, ground floor stairs lead to a hatch in the upper floor or, as in some cases, lead to a full door. Most stairs are open; some have a closed backside with a sheet of metal or plywood. This closing off occurs in two situations. First where hygiene is an issue, e.g. when the stairs are in front of a teashop (Photo 126), or a tailor shop (Photo 127). Second, when the stairs sit inside but are part of the façade (Photo 125).

How it Works

The steps and beams are made of welded steel strips and L-profiles, whereas round tubes are for handrails. Over a coat of red lead, paint of any color is applied. Most stairs show a generic design, which is an indication of shared knowledge of best practice and specialized production. Smiths produce on order with an almost standardized design.

Climbing steep stairs requires sufficient handgrips. Although most stairs are equipped with handrails, one often finds a one-inch thick rope hanging in the stairwell (as in Photo 126), providing additional support. Knots every one foot or so afford proper grip and make the rope a welcome aide. Stepping down from a floor onto a steep ladder is not easy either, and the rope is in fact a necessity. It is more versatile than for instance a pole since one can pull it for use, push aside if in the way, or even simply ignore, as knocking ones head against it is harmless. The rope affords the use of steep stairs and thus helps to save space.

Photo 128. Stairs are of a generic design and deliverable in any color. January 17, 2013.

Photo 129. Moving the lower half of the stairs into the street gives extra storage room. January 16, 2013.

There are several reasons for placing ground floor stairs outside. First, it saves valuable indoor space. Second, it affords renting out the upper floors as it provides independent access. Some stairs have a landing half way. It is a way to create extra storage space

under the stairs by moving one half of the stairs towards the street (Photo 129). Since the upper half has anchors in the stairwell, it cannot be moved. The gained space under the landing comes at the price of having to duck when using the stairs.

Stairs on upper floors are often indoors, allowing the space directly surrounding the stairs to be used for other purposes too. In multistory buildings, the stairs form a series circuit, i.e. they almost form one continuous staircase to the top from which one can step off at the desired floor, as is shown in the left part of Drawing 25. Not only is such an arrangement the most space-efficient, it is also the most convenient when hoisting materials and finished products, as in Photo 130. In case different occupants are using the floors, a simple wall can screen off the stairs, thus forming an enclosed stairway. This affords renting out floors separately. In comparison, stairs that are located directly above each other require landings at the side and thus need at least twice as much space, as is shown in Drawing 25. These two staircase layouts are emblematic of the difference between mass production and vernacular construction. Mass production requires that products be of identical design, like the parallel stairs and the layout of the adjacent floor, whereas vernacular construction affords the more pragmatic solution of the serial stairs.
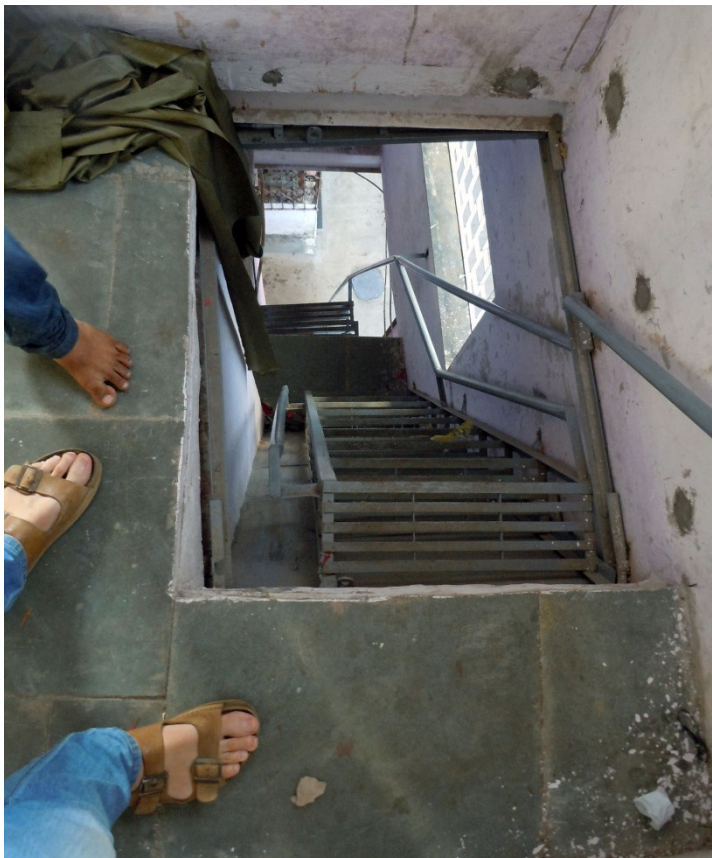
Photo 130. For people carrying goods, stairs in a straight line are the most convenient. From the workshop, it is easy to hoist up raw materials and hoist down finished products. April 8, 2013.
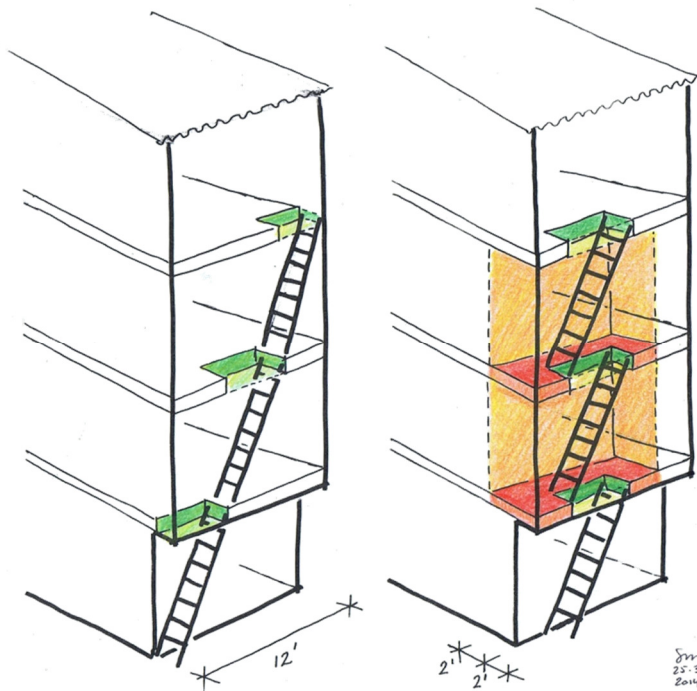
Drawing 25. The serial stairs on the left are more space-efficient than the parallel stairs on the right (24 sqft vs. 64 sqft). The latter require turn-around floor space (red), which in fact claims volume (orange).

Photo 131. Stairs leading to the first floor front door. January 16, 2013.

Another part of the spatial context of stairs is the layout of the stairwell. There are two ways to access the first floor from the stairs. One is by a door in the wall (Photo 131 and Photo 132); the other is through a hatch in the floor (Photo 126, and Photo 133). The hatch is the most common. To step from the stairs into the room is in both cases not a problem. Getting out however is another thing, as it requires agility to safely step out

of the door on the stairs (Photo 132). If the upper floor sticks out over the lower, it is possible to make a better foothold on the stairs by using a stairwell in the floor instead of a door in the wall. It is a solution with many advantages. First, it is cheaper. A door-and-frame is in both purchase and maintenance more expensive than a floor hatch. Second, the stairs are better accessible through a hatch since on both climbing and descent, support is available around the stairwell (Photo 130 and Photo 133).

Photo 132. Stepping out of a door onto steep stairs is less comfortable than down through a stairwell. January 20, 2010.

Photo 133. Stepping down through a stairwell. In Dharavi, the most common type of first floor home entrance is a stairwell-cum-hatch. January 17, 2010.

Photo 134. Vertical hatch as a mini front door. January 3, 201.

What it Means

Stairs and their design of course come from the logic of spatial economics. First, stairs afford the stacking of built spaces, i.e. they afford multistory building and thus the typical urban landscape. Stairs are the *sine qua non* of FSI[26]- and FAR[27]-policies since only by the existence of stairs can floor area be made bigger than the underlying land. Stairs themselves however are space consuming since the space both under and above them is of limited usability. The simplest way to reduce the space taken by stairs is to reduce their footprint, i.e. make them steep and narrow. Steepness goes at the expense of comfort. In principle, steepness can increase to vertical, in which case the footprint is near to nil. The width of the human body limits the narrowness of stairs and indeed, most stairs are about two feet / 60 cm wide. The trade off made in reducing stair-space, is of comfort in living space against comfort in climbing stairs.

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[26] FSI = Floor Site Index. The proportion of floor area to site area is an instrument in zoning plans and urban planning.
[27] FAR = Floor Area Ratio, a concept identical to FSI.

The pressure to economize on space taken by stairs is particularly high due to the already small sizes of the plot. A staircase of 10 m² can easily serve 300 m² of apartments it would however take all the space available in a typical Dharavi dwelling of 10 m². Even with all economizing ingenuity applied, the stairs in the dwelling take relatively more space. For example, four 75 m²-apartments combined can do with one comfortable staircase of 10 m² (=3%) whereas a typical Dharavi dwelling of 10 m² will need 1 m² (=10%) for a bare minimum staircase. The impact of these percentages can only be felt by imagining what it means to be left with only 9 m² and see 1 m² disappear, or to remain with 72 m² and sacrifice 2,5 m².

For the same reason, galleries that connect horizontally neighboring dwellings are rare. A gallery must span the full width of a dwelling in order to reach the next, whereas a staircase will require only half that space. At best, two dwellings share one staircase, using a minimum of landing.
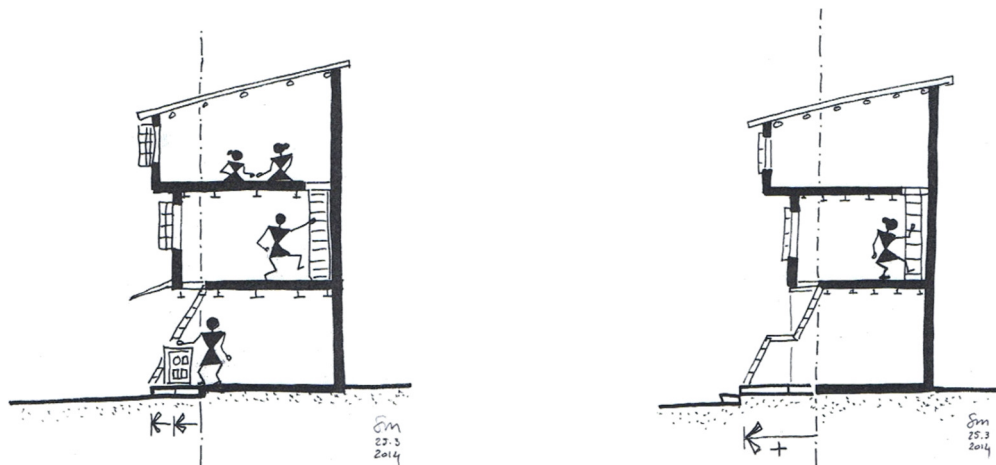
Drawing 26. Moving the lower half of the stairs out is part of encroachment tactics (see page 256).

Ground floor stairs, and where exactly they touch the ground, can give information about ownership and communal space. In situations with strict formal property systems, one cannot build stairs in front of the house if that would be on public land. As a result, stairs must sit inside the private property boundaries. The houses in Worli Koliwada show stairs that are directly accessible from the street but still sit inside the property, as in Photo 125. Many houses in Dharavi's Mahatma Gandhi road however, have their stairs simply outside on the street. Thus, the house extends outside its footprint, saving valuable indoor space. It is an example of *encroachment*, the gradual extension of a building or a dwelling while appropriating space that is not one's own.

Emblematic of encroachment are stairs with a landing halfway, already shown in Photo 129. This process of encroachment is explained in detail on page 250, and summarized in Drawing 26. Initially, the ground floor stairs are of one flight and stand in front of a shop. In order to create interior space, the shop's counter is moved a bit outside. Once this situation turns out to be tenable, walls and awnings are extended into the street.

Then the lower half of the stairs is cut, moved out, and reconnected to the upper half via a landing. The new space under the landing is good for storage.

The spatial logic described here affords reading sociological information from the architectural structure. For example, a building can be owned and used by the same family, but it can also be subdivided and sublet. One can read the subdivision from the structure of indoor and outdoor stairs. Indoor stairs connect rooms that are part of one property, whereas outdoor stairs connect the property with the street. Combinations are also found. Common is the pattern of outdoor stairs on the ground floor, in front of a shop for example, with indoor stairs on the upper floors where an entrepreneur is running several departments of his company. The workers can use such company space as dormitory. The distinction between residential, commercial, and industrial is fluid.

Photo 135. Horizontal neighbors rarely share stairs. The house on the left is older, since both its floor level and the level at which it touches the street, are lower. A white tarpaulin keeps dirt away from the blue water container. January 21, 2013.

In multi-storied buildings, occupants share stairs for the simple purpose of saving space. Horizontally neighboring structures however, often have their own stairs. Common is the sight of two identical stairs leading up to two dwellings that could easily share one, e.g. Photo 132 and Photo 135. Sharing stairs is apparently not that obvious. First, the two buildings were probably not built at the same time, and sharing the existing stairs would require quite some negotiation between owners. A future change of one of the buildings will require another round of adjustment and

negotiations, whereas separate stairs afford independent development. Second, economy of space is less an issue in the case of double stairs leading from the street to the first floor, since the space occupied by the stairs is not part of one's own property. It is an encroachment into the street, the public realm. Combining the two stairs would save space not owned by the neighbors involved, and doing so is thus pointless.

This encroachment apparently does not occur in the Worli Koliwada example in Photo 125. All the stairs there sit neatly inside the property boundaries. Worli Koliwada is not informal settlement but a fishermen village now part of the city of Mumbai. Building stairs in front of the house in the public realm is an offence in the formal city.

This house shows how stairs are the silent witnesses of incremental development. At the time, the house had only one story, things were easy. Then, a story was added and in order to gain access to that storey, stairs were built. The only feasible location was the edge of the well that sits in the corner formed by the two houses. The stairs are equipped with a closed backside, as otherwise dirt would fall from the steps into the well. The red hand railing is closed for the same reason. Once the story was added, another flight of stairs was needed for access to the next roof. Those second stairs were almost impossible to make. An additional piece of roof was added to provide a landing to the new roof. It doubles as a canopy along the façade, and will in future allow a bigger next story.

 The way Dharavi develops is typically incremental. It grows and evolves gradually, unlike the planned city where buildings are considered finished after construction. This continuous evolution, or incremental development, has the typical side effect of

challenges accumulating in the top floor. For example, when again a story is added to a building, it is not unlikely that the already present stairs do not leave sufficient space for another flight of stairs. In that case, the stairs to the top floor are somewhat steeper in order to compensate for the lack of horizontal space. The beams of the stairs can be cut to make things fit, but that will not fix the entire problem. As stairs are produced according a generic design, they are to be mounted under a certain angle, and the angle of the steps is linked to that. As a result, the steps will no longer be horizontal on stairs that are mounted steeper than foreseen.

Summary

In this chapter, we have seen that stairs reveal much of a building's history. They show if a building was constructed in one go or through incremental development. This chapter also showed the important role that stairs play in the economics of living space. Space saving is achieved through pragmatism and on-the-spot solutions, whereas standardization and industrial production tend to be space consuming. Summarizing, stairs are the result of many negotiations: between the home and the street; downstairs and upstairs; neighbors and the human body; and between money and comfort.

Furniture

When asked about what they need most, every Dharavian answer with 'a bigger house'. The question of how to fulfill that wish is not the subject of this chapter. First, there are libraries full of ideas and plans already, and second, the aim of this PhD thesis is to describe evolutions in the way of living. This chapter will look at how people in vernacular environments use space, how furniture eats space away in functionalism, and how people cope with small spaces.

Vernacular Living and Modernity's Furniture

Again, a comparison will be made here between the countryside and the city. In the chapter on *kacca* and *pucca*, it was mentioned that in the countryside many of daily activities take place outside the house. The layout of the house reflects this way of living. As we have seen, the basic purpose of a house is to keep belongings safe, and a single room can already do so. Therefore, the basic dwelling indeed consists of four walls and a roof. The absence of partitions allows maximum effectiveness in the use of space, as use can change over the day. In modern terminology, such a room is multi-functional. In the morning, beds are folded and stored. The floor serves as place for having breakfast, lunch, and dinner. Since such use requires hygiene, flooring is made of easy to clean materials, like cow dung, natural stone and glazed ceramic tiles. Shoes remain at the entrance of the house. The rest of the day, the floor can accommodate whatever activity. Few uses have a permanent place, except cooking on a fixed fireplace.

Photo 136. In this rural *kacca* house in Kelthan, storage is the primary purpose of all furniture, including the desk. January 18, 2013.

Photo 137. Traditional house in Kelthan. The bed affords storage since it has two drawers. January 18, 2013.

Photo 138. In order to keep food safe from rodents, everything is on legs. February 14, 2010.

Photo 139. Bedding folded and stored during the day...

Photo 140. ... so the room can be used for eating and other purposes. Pundhe, November 8, 2012.

Photo 141. The first room in the house is where guests are welcomed...
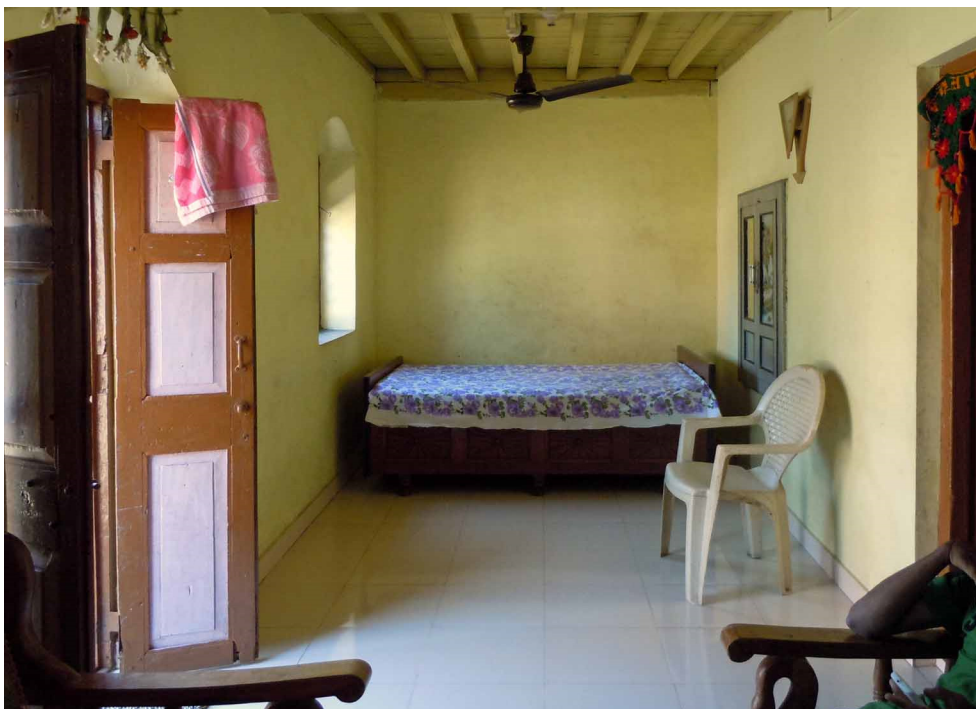
Photo 142. ...it has a couch used as bed at night. Pundhe, November 8, 2012.

As long as kept to a minimum, furniture will indeed afford maximum flexibility. Beds are often mats that one can easily put away. Many cultures know futons that can be rolled and stored (Photo 139). Since storage is an important purpose of the house, shelves, chests, and cupboards are the primary furniture (Photo 136). Besides the extra space shelves provide, the advantage of putting them higher up is that it keeps items

away from the floor and thus protects them from dirt, animals, and water. For the same reason, furniture is often on legs. A second way to save space is to use furniture for more than one purpose. Chests for example double as couches during the day and as beds at night (Photo 142, Photo 145, and Photo 147). In a medical clinic, the doctor uses a waist-high cabinet as examination table, et cetera.

Photo 143. In this *kacca* house in Mumbai's Sanjay Gandhi National Park, furniture keeps things off the floor, out of animals' reach. A bag of rice is kept on a chair. February 14, 2010.

Chairs are not of primary need, since one can easily sit on the floor (Photo 140). Once chairs are present, they claim space from other use (Photo 144). In for example Shaker furniture, a chair could be put aside by hanging it on a peg high on the wall. Thus, the Shakers saved precious multipurpose floor space. Chairs have the effect of fixing space to a single use. As is visible in Photo 144, the effect of tables is even stronger, since they also fix the space of the chairs that surround them. Moreover, a dining table is higher than a coffee table and requires higher (and therefore extra) chairs.

One could say the introduction of ever more furniture is typical of functionalism. In functionalism, *use* is categorized and assigned as a certain *function* to a room or a piece of furniture. It is in every sense related to industrialization and, in analogy with the 'division of labor,' one can speak of a 'division of living'. Furniture divides the continuum of living into separate activities. As a result, in modern housing one finds bedrooms, kitchens, living rooms, studies, bathrooms et cetera, accompanied by a range of specialized single purpose furniture. In vernacular architecture, the use of space follows what is needed at a given time of the day, i.e. it follows demand.

Photo 144. In this modern house near Mumbai, separate groups of furniture afford different activities. They define the functions into which the daily routine is divided, as is typical of functionalism. Note the use of tables in combination with chairs. November 24, 2012.

Another aspect of the use of furniture is the ability of the human body to accommodate to a given situation. In vernacular environments, people seem more agile and capable of adapting to a situation. They can sit cross-legged for hours whereas most modernized people got completely out of the habit. Sleeping on a thin mat is also no problem, whereas modernized people consider it close to torture. In both these examples, furniture softens the interface of the human body and the hard floor. As a result, people become more dependent on furniture and thus on more space. The human ability to accommodate requires exercise and without regular exposure to stress factors, certain comfort even leads to intolerance (Liao & Cech, 1977). One of our hosts in India claimed that a mattress thicker than the mat in Photo 148 causes him back pain. The need for furniture and the ability to do without are therefore also a matter of physical training (or lack of it).

Furniture causes single purpose use of space and is therefore space consuming. In coping with cramped living space, an important strategy is to avoid furniture other than for storage, and furniture with only a single purpose. Moreover, the presence of furniture does not necessarily come from demand. As we have seen, in vernacular environments little furniture is common whereas the abundance of living space and furniture is typically modern. If we consider vernacular the default situation, furniture is a luxury that comes to people in a supply-driven manner.
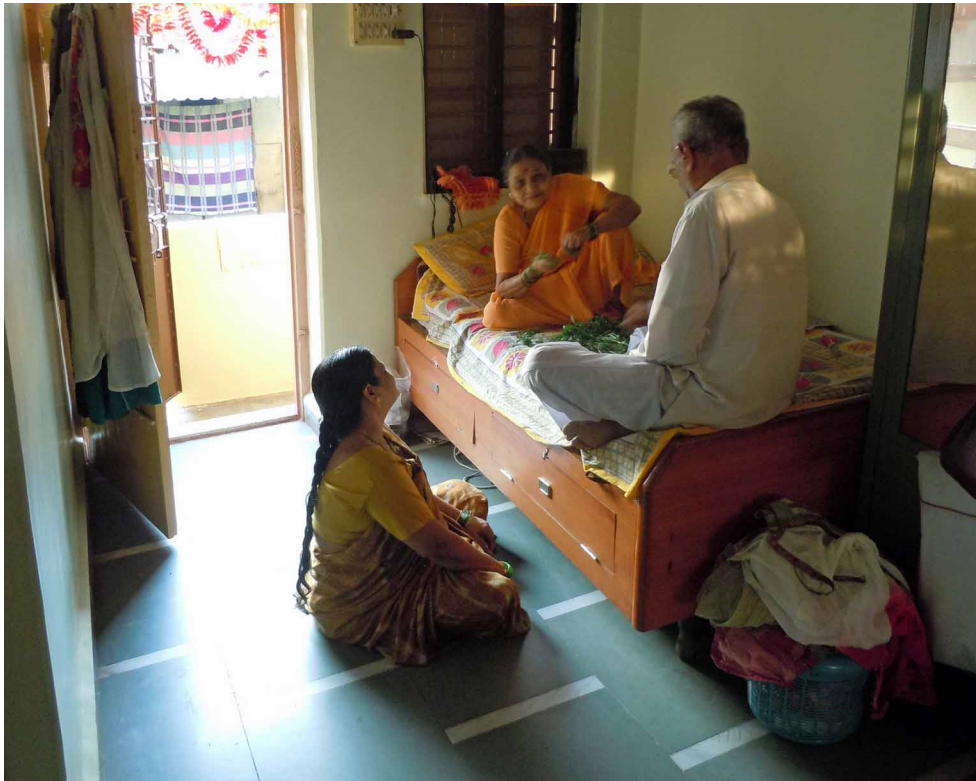
Photo 145. The guestroom at the main entrance...
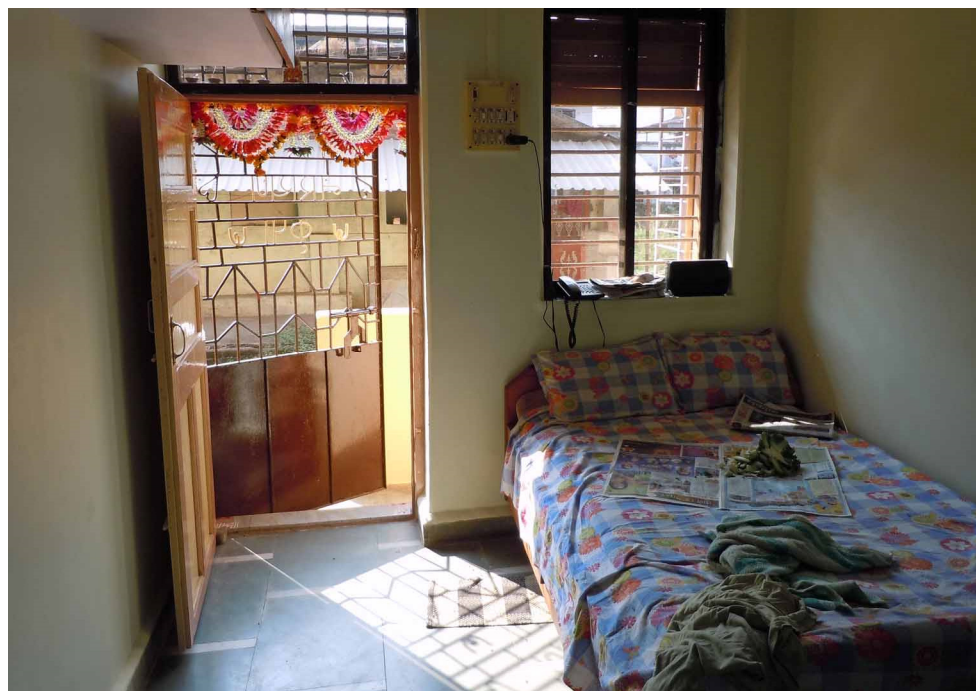
Photo 146. ... doubles as master bedroom. Vasind, November 21 and 13, 2012.

Photo 147. One can use a bed for sitting...

Photo 148. ... whereas one can always sleep on the floor. Vasind, January 27, 2013.
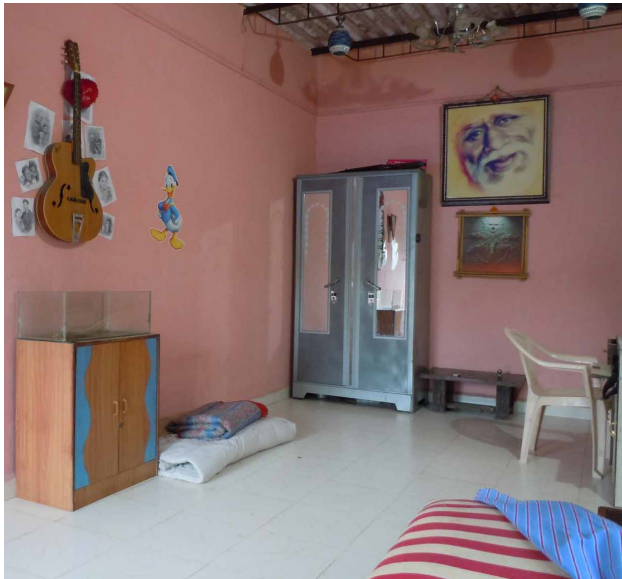
Photo 149. The *kapat* is a steel cupboard used to keep valuable belongings. It usually sits in the room where the married couple sleeps. Vasind, July 15 and 12, 2014.

A typical piece of furniture found in many an Indian household is the *kapat* (possibly an Indian corruption of *cupboard*) a steel cupboard that also serves as a safe (Photo 137 and Photo 149). The *kapat* is emblematic of the basic idea of the home: the place where one can keep his belongings safe. This explains why the *kapat* is so ubiquitous and why the most basic furniture arrangement consists of only a *kapat*. In the daily routine of living, any other item can be put aside or used for other purposes, for example sleeping mats and the chest/bed/couch. Closer look at the *kapat* reveals a pattern that illustrates the transition from vernacular to modern living. To understand the position of the *kapat* is to understand the way of living.

It is not noticeable in a single-room house, but the *kapat* usually sits in the master bedroom, a functionalist term for the room where the married couple sleeps. In a house where the son gets married, a second *kapat* is introduced in the newlywed's bedroom. Apparently, the *kapat* is the centerpiece in home making, this time by the new couple. This private use of the *kapat* is much unlike the shared use of all other household items. In vernacular settings, usually everything is shared: rooms, food, money, information et cetera. The importance of the *kapat* is symbolic of the effort to keep the private to a minimum in an otherwise convivial environment. The following drawings explain how the transition to modern and the individuality that comes with it are visible in the changing role of the *kapat*.
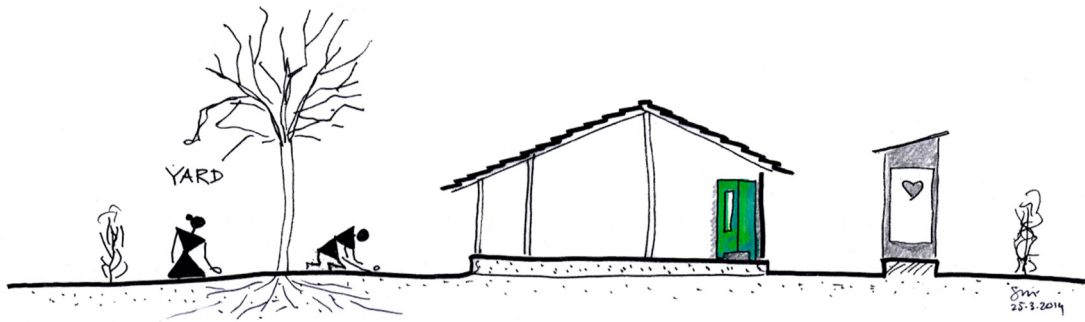
Drawing 27. In rural areas, there is almost no hard boundary between the inside of the home and the rest of the world. The *kapat* is like a vault in open space.

Drawing 28. In urban informal settlement, the *kapat* is inside the private home, which is still directly connected to the public alley.
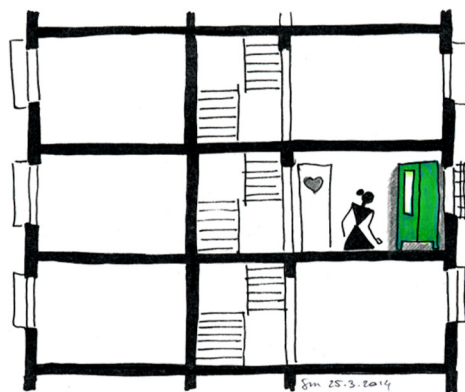
Drawing 29. In a condominium, the private home is connected to the semi-private space of the hall and staircase. There is no direct connection with the public domain of the street. The *kapat* thus has protective layers of private and semi-private space around it, when compared to Drawing 27.

As mentioned, the *kapat* is a steel cupboard used to keep valuables safe from theft, curious kids, and animals that tend to nibble on any paper regardless of its legal importance. The safety issue is the same in all three drawings above. In the transition from vernacular to the modern condominium, a pattern emerges of space the home

becomes less shared. In Drawing 27, the *kapat* sits in a household that extends beyond the physical boundary of the house. Moreover, the convivial way of living seems to reach into the house. In Drawing 28, the home is confined to the house. As a result, the *kapat* is less exposed and it loses a bit of its protective role. Still, the home has a direct connection with the street and community life. In Drawing 29, little direct connection with the outside world remains. The home is confined to the condominium; its front door opens to a hall that is neither private nor communal. The *kapat*'s protective character becomes almost irrelevant. Whatever is private and individual expands, whereas what is shared is further reduced. It shows how the house is taking over the role of the *kapat*, and how the individual is secluded from the rest of the world. Inside the concrete high-rise, the steel *kapat* is futile.

Transition

Photo 150. Basic furniture in a *pucca* house in Bihar. A knee-high board affords sitting, sleeping, eating et cetera. Steel suitcases on the concrete shelf serve as *kapat*. Susant, July 29, 2014.

Households that have recently made a transition illustrate the change in use of space and the exchange of way of living for furniture. For example in the case of moving from a *kacca* to a *pucca* house in rural Bihar (Photo 150). Since the use of concrete and bricks requires major investments, the rooms in the *pucca* house are small. The vernacular way of living continues, going well with the size of the room.

Photo 151. A house in Bihar, the native place of one of the Dharavi students. Jahpa, August 1, 2014.

A student's home in Dharavi (Photo 152) illustrates how the vernacular way of living they are used to (as in Photo 151) allows people to live in conditions that modernized people find intolerable. A room of six m² is home to four students. Indeed furniture is kept to a minimum, the toilet is somewhere outside, shoes stay at the entrance, and the floor can be used for many activities. Like in the countryside, much of the daytime is spent outside. Kids go to school, students go to college, and men go to work or hang out in a teahouse. The *mori* (wash place) in the corner is much the same as a pump behind the house in a village.

Photo 152. A 1:20 scale model of an actual students' home in Dharavi. The students' way of living is much the same as in their home village in Bihar.

Photo 153. Storage on shelves and keeping things off the floor are typical of living in tight spaces.

Photo 154. This 2 x 3 meter room is the home of four students. The floor is mainly empty.

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Photo 155. In this modern apartment, the living room doubles as guestroom. Vasind, November 22, 2012.

Even in a modern house, the effectiveness of open floor space is appreciated (Photo 155). The living room is spacious compared to the cramped bedrooms, and can easily accommodate overnight guests.

Summary

Furniture is emblematic of the 'division of living' that comes with modernity. Living space is divided along different kinds of use (sitting, eating, sleeping) each going with a specific piece of furniture (chair, table, bed). The modern life style is less demanding of the human body as it affords postures that require less agility. Sitting on a chair for example requires less folding of limbs than sitting on the floor. In essence, the human agility and the capability to adapt are exchanged for furniture.

In the traditional 'primitive' house, this differentiation of living space is less specific or not present at all. The absence of furniture is part of the same pattern. The vernacular way of living is therefore more space efficient than the modern. This more efficient way of living is also the way slum dwellers deal with tight spaces.

The shift from the essentials of storage and shelter to a diversification of accommodation and bodily support mark the transition from vernacular to modern.

Kitchen

The Meaning of Cooking

Kevin Kelly described cooking as an external stomach (see page 73) and the kitchen is indeed home's most advanced extension of the body; the place where symbiosis is most concrete. It is where we are nourished and where food is prepared in order to give us energy. In many cultures, the kitchen is the most sacred place in the home. In Hindu households, the *devara* or 'home for the gods' is often found in the kitchen (Photo 156).

Photo 156. The *devara*, home for the gods, marks the kitchen's sacred character. November 5, 2010.

The meaning of cooking as the heart of the home is so profound that disruption and violation are deeply felt. Pavement dwellers pointed out that while suffering destruction of their home, "Most traumatically food is being cooked, so it just gets thrown out on the ground when the vessels are picked up and taken" (Hollick, 2011).

Evolution

Since the use of firewood and dung as fuel causes smoke, open fire was initially kept outside the house or in a place affording sufficient ventilation. Semi-open stoves and smoke-holes in the roof allowed indoor use of fire. Since smoke has an insect-repellant effect, it also has a conserving effect on wooden roofs. Still, houses need an open structure in order to have sufficient ventilation. In the transition from *kacca* to *pucca*, the *pucca* house affords less ventilation. The kitchen therefore is an annex to the actual house (Photo 158 and Photo 160). The introduction of gas as a cooking fuel afforded further *pucca*fication. Gas however, is only available as a commodity and the evolution of the kitchen is thus linked to commodification. The handmade loam stove is

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vernacular. It is cleaned, repaired, and improved as in Alexander's *unselfconscious* process (Photo 157).

Photo 157. Courtyard kitchen in Bihar. The stove is handmade of loam. August 1, 2014.

Photo 158. The kitchen is in a *kacca* annex to the *pucca* house. August 2, 2014.

Photo 159. The semi-open-air kitchen affords sufficient ventilation for use of dung and firewood. August 2, 2014.

Photo 160. Interior of the annex in Photo 158.

Kamu Iyer [28] described the changes the kitchen underwent following the introduction of commodity building. From the late 1940s, flats were described by the number of rooms. It is where the BHK-terminology started. 3BHK stands for 3 Bedrooms + Hall + Kitchen in which the Hall is the living room. Once housing was built for sale, i.e. became a commodity; the kitchen became a separate room. In addition, stand up cooking became common with the introduction of the worktop and the gas stove. In sitting cooking, *sarees* sometimes took fire.

Stand-up cooking is easier with gas stoves and closed stoves. The use of worktops is comparable to that of other furniture and follows the same pattern as the introduction of tables, as explained in Furniture (page 217).

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[28] In interview with SdM on December 20, 2012.

Photo 161. Minimal kitchen in a Dharavi student slum dwelling, reminiscent of the Bihar kitchen in Photo 157. April 16, 2013.

Photo 162. The kitchen in this *pucca* house has worktops affording stand-up cooking. The spacious floor however is at least as convenient. January 18, 2013.

Stand-up cooking affords designing smaller kitchens in commodified building. The kitchen of the rented housing in Photo 163 takes a fraction of the space available in the owner-built rural house in Photo 162. Especially when the kitchen is made as a separate

room (functionalism's approach), the sitting kitchen is less economic. Both the kitchens in Photo 162 and Photo 163 contain a diversity of items. The variety of plates, cups, pots, utensils, and containers follows the increased engineering of the household. Commodification fits as hand-in-glove as the specialization of purpose requires the presence of more items in order to compensate for the loss of generalness. In the slum dwelling kitchen in Photo 161, like the Bihar kitchen in Photo 157, the *use* of items diversified, not their material appearance.

Photo 163. Stand-up cooking saves space in this Dharavi *chawl*. January 10, 2009.

Commodification, diversification of utensils, and verticalization mark the kitchen's transition from vernacular to modern. The diversification of utensils follows directly from commodification since the market affords the spread of handy but not necessarily urgently needed items. Commodification of floor space, especially felt in the city, reduces the size of the kitchen. Whereas they also allow the diversification of kitchen items, commodities like gas stoves and racks facilitate verticalization i.e. stand-up cooking. In other words, commodification and verticalization go hand in hand. The practice of cooking as found in the remote hamlet in Bihar, i.e. using few items in many ways, is directly recognizable in the practice of the slum dwelling.

Wedding

Home is the building that is closest to us. As they say, home is where the heart is. Home *is* the symbiosis of man and his house. Life starts with being born in a home and may involve changing homes several times. This chapter investigates the making and changing of home in the cases of (1) a family moving into a newly built house and (2) a wedding, i.e. a change of family composition in an existing home.

There are three formats to describe family: the extended, the joint, and the nuclear family. The *extended* family includes parents, spouse, siblings, aunts, uncles, cousins, nephews, and nieces, i.e. all family members related by bloodlines. The extended family can occupy several homes and does not necessarily form one household. The *joint* family consists of multiple generations living under one roof, sometimes subdivided into households; for example an elderly couple, their children with spouses, and their grandchildren. Even when the joint family holds several households, it is still one home. Traditionally, the sons stay with the family, while daughters move to the joint family of their husbands. For this reason, the birth of a son is an important guarantee for future support of the elderly. In the matriarchal society found in Kerala in South India, the opposite applies: a son moves to his wife's home. The *nuclear* family consists of one couple and their children (if any).

Home Making

The process of making a place one's home includes personalization and familiarization. The latter is about familiarizing oneself with a new house, a new home, by getting in touch with it. Personalization works in the other direction; it gives the house a personal touch and builds the image of who lives there. At first, a new home is alien to one. Rituals like new home celebrations and housewarming parties typically serve de-alienation. Besides chasing the alien character away, such rituals announce the arrival of a new symbiosis. With the community as a witness, a person or family is wed to a new home.

The Patil family had their new house built in 2011. Since Mr. Patil is a contractor and actually built the house, the family could make the design exactly to their wishes. After completion, the family performed a *puja* (ceremony) to inaugurate and celebrate the new home. Key parts of the celebration involve the invitation of gods into the home, a ritual connecting the home with the world, the universe, with God. Besides *pujas* by Hindu priests, the occupants also perform rituals to invite the gods. Mr. and Mrs. Patil went by the entire house to place a 'first touch' and thus bless every room (Photo 166 and Photo 167). The handprints communicate the presence of people and signal that the building is no longer untouched. From then on, it is in use; it is alive; it is in symbiosis.

Photo 164. Mrs. and Mr. Patil are welcomed to their new home.

Photo 165. *Puja* **for inauguration of the new home.**

Photo 166. Mrs. Patil as head of the house went first in placing her handprints.

Photo 167. Mr. Patil as head of the family then placed his handprints below those of his wife.

All four photos April 29, 2011 by Vinayak Devare.

Similar rituals are performed after redecorating an existing home. Since the home may have changed quite much, the family invites the gods again and applies new blessings. Obviously, they invite other family and friends to celebrate the reconfirmation of the symbiosis.

The application of handprints is also part of Holi, a festival celebrating the arrival of spring and the victory of good over evil. Besides the known ritual of throwing colored powder at each other, people bless each other's homes by placing colored handprints near windows and the doorway. The doorway is an auspicious place for such blessings since it is where the home touches community and the outside world. As mentioned, in Chinese *Feng Shui* the main door is the mouth of a building. It affords feeding, breathing and communicating. Putting a handprint near the door is like kissing the home on its cheek. The Holi ritual is reminiscent to people greeting cheek to cheek and reconfirming their relationship.

Photo 168. People leave handprints as blessing for a home during Holi festival. March 24, 2008.

People put handprints as blessing also on for example, a boat, stairs, or the main pole of a building's structure (Photo 169). Besides the intentions of blessing and warding off evil, the handprints literally express that people are in touch with the building. The prints are the symbols of symbiosis.

Photo 169. Handprints blessing a staircase. November 8, 2012.

Similar to celebrating a new home, taking leave of a home is loaded with meaning. If not done with appropriate care, it can cause emotional stress. Pavement dwellers explain that eviction and having to leave is less traumatic when one is allowed to vacate and take down the dwelling oneself. When authorities perform the eviction and demolition, dwellers experience it as the murder of their home (see page 131).

Preparing for the New Family Member

Like the home being a reflection of a person's self, the home is also a representation of the family as a whole. Changes in family composition are visible as changes in the home. A wedding is an example of change in family composition. In Indian tradition, the bride moves to the home of the groom's family. In the practice of arranged marriages, a major factor in selecting the bride is whether she and her mother-in-law to be (i.e. the head of the household) get along well. The focus of the arranging process is on the connection of two families and the establishing of new relationships. An *arranged marriage* is based on the relationship of two families, whereas a *love marriage* is based on two individuals. The first is vernacular as it is about homes and households, whereas the latter is typical of modern individualism.

Photo 170. The groom's father decorates the doorway with ritual items as a welcome to the new family member, the bride. December 21, 2012.

In preparation of receiving the new family member, the house of the groom's family undergoes extra maintenance, reconstruction, improvement, and redecorating. Thus, the home that is new to the bride becomes also 'new' to the family already living there. Shortly before the wedding, family places several ritual items in the home. One of them

is a decoration at the doorway, marking the introduction of the new family member (Photo 170). In addition, the family brings the environment of the home in good shape as well. Even a road that has been waiting for repairs by the municipality for years is taken to hand in joint effort with the neighbors. Although formally public space, the notion of common space still exists and allows people to improve their home beyond the limits of their house.

Wedding Ceremony

The first part of the wedding ceremony takes place at the home of the bride or a venue nearby. Part of the ceremony is the groom riding on a white horse, marking the journey to the bride's home (Photo 171). Rituals can take a whole day. Then both families travel to the home of the groom where again a wedding ceremony takes place. Besides the wedding of the bride and the groom, and one family to the other, an important ritual is that of welcoming the bride in the new home. A wedding reception is a ritual where friends and community come to congratulate the couple and the families, i.e. to see the changes that take place, to see what happens with the symbiosis. In vernacular environments, the reception can take place in front of the home, in common space where a tent makes a colorful banquet hall. In the formalized city, one would need a permit to occupy public space. In the commodified world, one rents a venue. Photo 172 shows the informal variety in urban slum; what is supposed to be public space goes for common.

Photo 171. A wedding couple carried by a horse and surrounded by musicians. The home is extended with a decorated canopy. The footprints at the doorstep symbolize a welcome to the gods. Warli style painting (detail) by artist of the ASSP Centre in Masvan 2013.

Although the focus of the whole ceremony is more on the families than on the individuals (as in western style weddings), the wedding is especially eventful for the

bride. She leaves her family behind and moves to a new home. It is not unusual to witness a bride with an unhappy face. Many a bride feels she is starting a completely new live and taking leave of a previous. The groom's family therefore takes extra care of the bride in the early days of the marriage in order to encourage bonding. For several months, the couple shall not travel, i.e. spend the night elsewhere then at home. In addition, new couples live for at least seven years with the groom's family.

Photo 172. A tent is put at the entrance of Kolya Khata for a wedding. Although the building was intended as commodity, the action is communal and informal. April 19, 2013.

Photo 173. At every wedding, the mural is updated, marking the most recent. July 14th, 2014.

It is common to document weddings in photography and video recordings. In traditional houses, murals document weddings (Photo 173). Through such a mural, the event of the wedding (kinetic) is linked to the house (static); i.e. the marriage is an extension of the home.

Although families of 150 are not unheard of, a home cannot grow infinitely and at a certain time, parts of the family split off to start a new home. It is common to see a couple moving out to the city and starting a nuclear family. Those who are used to the social richness of the joint family feel the transition to nuclear is not always a pleasant one. Some move back. Kamu Iyer points out that a push factor in moving to an apartment is that it affords people to escape from caste restrictions. Nevertheless, Iyer recalls his cousin: "When they moved out to a flat [...] they missed living with other family. [...] She said that living in a *chawl* gave her a sense of security. [...] They returned from privacy and independence, which they said was isolation, to living with others" (Iyer, 2014).

In the joint family, hierarchy is important. Decision-making goes through a hierarchical chain, in which the grandparents are the most important. A difference between joint and nuclear family is the appreciation of privacy. The first regard it as isolation, whereas the latter see it as freedom. In the first, family members debate everything until they reach a joint opinion. Taking care is subject of feedback and the family acts as a mirror. Note the parallel that *Feng Shui* draws with the built structure: that a *chawl* often has multiple exterior doors whereas a modern apartment typically has only one. In *Feng Shui,* this is emblematic of the quality of communication; more doors means more mouths and more talking. In the joint family, all preferences and hobbies are known and taken into account. In the nuclear family, egos are bigger, as if there is more space per ego available. Teachers observe that joint family children are more mature, free, and comfortable. Privacy in the joint family is limited, as everything is open. The privacy felt in a nuclear family is considered freedom. The members of a nuclear family are often busier with earning money, since living in the city is more expensive, whereas joint families put more action into the social, tradition, and debate. Communal eating is quality time and important for home making. A good ceremony satisfies everyone in the family.

Summary

In the transition from vernacular to modern, both wedding and the home have moved their focus from the family to the individual. Where at first two families are wed through two persons, the modern wedding is about two individuals getting married. The same goes for the home; in the first, one was connected to the social of the new home, whereas the modern make their house something personal.

Slum or Informal Settlement?

The Debate

Much controversy exists about the use of the word 'slum'. Because of its deprecatory connotation, many agencies and academics avoid using it and actively encourage others to do the same. Their main objection is the stigmatizing effect of the s-word. Many an activist regards the use of 'slum' by authorities and developers a deliberate attempt to discredit areas in order to get them slated for redevelopment by the construction industry. Hence, 'slum' has become a strong word in development rhetoric. It is arguable however that avoiding 'slum' is playing into the hands of developers and the construction industry, and frequent use by other parties could actually help de-stigmatize slum dwelling. This chapter investigates the backgrounds of the word 'slum' and its most famous replacement euphemism 'informal settlement'.

The controversy about slum is not just an academic discourse or a matter of political correctness. It is an everyday issue, also in Dharavi. Slum as a label plays a role in the lives of those who live in slums and their neighbors who insist they do not. As discussed on page 157, settled dwelling in Dharavi is a mix of several distinct typologies. These distinctions are not limited to the physical world, and have parallels in the social and political too. Koliwada residents for example are often precise about the status of their property and leave no doubt about the fact that their home is not slum. This insisting on status is understandable in the light of the long history of slum redevelopment schemes Dharavi has gone through. The chapter about Slum Improvement (page 261) investigates this history further. For many residents, redevelopment means a direct threat to their home and they therefore prefer not to get involved in any scheme. The safest position is to live in a house not considered a slum dwelling and to have sufficient legal tenure to avert expropriation. Consequently, a segregation occurs into *have* and *have-not* regarding land title. This segregation has far-reaching consequences. It eventually boils down to the segregation into natives and newcomers. It is no coincidence that the Shiv Sena party enjoys much support in Koliwada. Their nationalist agenda, openly advocating 'Hindus first', is an important anchor for Kolis who feel surrounded by a majority of (mainly Muslim) slum dwellers. The fear of eviction in the name of the 'the common good' has deepened the segregation into formal and informal. Nationalist rhetoric easily turns it into a frontline between religions.

One of the issues in defining slum is that besides a perhaps agreed definition, also a certain meaning is attributed which is much based on the observer's position. Peter Marris (1979) put it this way: "A slum is only a slum in the eyes of someone for whom it is an anomaly - a disruption of the urban form and relationships which to that observer seem appropriate to his or her own values and perceptions." The director of the urban planning department for example may see slums as blights and eyesores, whereas the

inhabitants see the tight knit social networks. Marris at this point already sees a way out of the problematic of slums: "Problems, too, exist only in the context of someone's expectations - and according to your interests, your beliefs, your opportunities, the problem may change its definition or disappear."

The importance of definition is widely understood in academia where many a debate stalls on 'it depends on what definition you are using…' The absence of an unequivocal definition also affords arbitrary governance[29]. The state of Maharashtra for example, simply said, considers an area slum when they consider it slum[30].

According to THE MAKING OF THE ENGLISH LANDSCAPE (Hoskins, 1977) the etymology of the word 'slum' goes back to the 1820s and refers to the geology of the land on which the upcoming large scale industries in England were built. Since steam-power was not yet available for trains in the early Industrial Revolution, most of raw materials and finished products were transported by canal-barges. Industries therefore were located near canals, often on grounds that lacked sufficient drainage. In those days, the local term for these marshy lands was 'slump,' meaning wet mire. The same word also occurs in Saxon and Scandinavian languages. Most of the accommodation for the working class developed near the factories and consequently, the ´slums´ were the housing that often suffered from drainage problems. The word ´slum´ therefore has its origin in the problematic location of housing.

As mentioned, the use of the word 'slum' is subject of much debate because of its negative connotation. Eventually, authors on slum issues often borrow their definition from THE CHALLENGE OF SLUMS, GLOBAL REPORT ON HUMAN SETTLEMENTS (UN-Habitat, 2003). The report starts with the observation that an agreed definition is needed in order to afford proper research and policy making, since quantification of the phenomenon is only possible when it is clear what exactly is being measured. Since the debates are numerous and the stakes are high, the report spends four pages on reaching an 'operational definition'. At its simplest, the report says, "Slum is a heavily populated urban area characterized by substandard housing and squalor"[31]. This phrase holds the three essential ingredients of slums: high densities, low standards of housing, and 'squalor'. Note that there is little overlap with the etymological origin.

Throughout the world and in various languages, slum is named after different characteristics. Some see materials as typical markers, like the French *bidonville* and South African *blikkiesdorp*, both meaning 'tin can town'. An agreed definition of slum by linguistics therefore is hard to reach. The report continues with a discussion on the 'notion of slums'. An important distinction is that of two broad classes of slums:

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[29] One example is the infamous 'windscreen survey' in Melbourne, Australia, during the 1960s, when two planners drove around and designated particular streets as slums for demolition without getting out of their car. (UN-Habitat, 2003).

[30] "'Slum areas' means any area declared as such by the Competent Authority […] appointed by [Maharashtra] State Government." ("Maharashtra Slum Areas Act," 1971)

[31] *The Merriam Webster Dictionary* (1994) Merriam Webster Inc.

- *Slums of hope*, which progress into more acceptable living conditions.
- *Slums of despair* are neighborhoods that decline and degenerate.

Processes that are typical of these two classes are described in *Death and Life of Great American Cities* (Jacobs, 1961). Moreover, Jacobs explains that neighborhoods can migrate from one class to the other and instead of remaining stuck in slumming, can actually become unslumming. When signs of unslumming are not adequately picked up by a municipality, the neighborhood can fall back to slumming again.

Where 'slums' once mainly described an uneasy phenomenon, the Housing Reform Movement of the 1880s in England turned it into an operational concept. From then on, it afforded policies and law making. The social movement in the 20th century however sought to rename the socially stigmatized slums and enriched the jargon with euphemisms like 'neighborhoods', 'hoods', 'communities' and the most known 'informal settlement'. Nowadays, it is politically correct to avoid the word slum, and academic lexicon tends to follow that trend. For many authorities and agencies however, words like slum, shanties, squatter settlement, and informal housing are interchangeable. The UN-Habitat report notes that in developing countries, slum mostly lacks the deprecatory connotation and refers more generally to lower quality and informal housing.

As mentioned earlier, informal is often put on a par with illegal. The semantics of legal, illegal, and extra-legal are a sensitive issue, since slums often have a stigma of illegality and wide spread crime. Kalpana Sharma (2000) argues that the idea that slums are the breeding place of crime is based on the fallacious assumption that those who break the law by squatting on vacant land, will inevitably break other laws too. Like Sharma, Robert Neuwirth (2005) points out that crowded areas are often the safest, since there 'are a million eyes in the street'. Moreover, most space in slums serves many purposes, which affords a constant presence of other people. Social control is very strong and petty crime is as good as impossible.

A tangible result of the formal-informal approach is visible on road maps. On the **MUMBAI CITY MAP** (Eicher Goodearth, 2009) for example, slums are depicted in one continuous color, without street patterns. The formal city however shows built up area in certain detail. Bearing in mind the example of sensitivities in Dharavi Koliwada, described above, a map like this can cause turmoil. In Dharavi on Map 4, Transit Camp (Rajiv Gandhi Nagar) and Kumbhar Wada are depicted as formal city, whereas the status of also legal Koliwada, on both sides of Dharavi Main Road, is unclear. Despite the differences in legal status, the architecture of the various areas shows much similarity. Most buildings in Thirteenth Compound (in the far west on Map 4, south of Mahim Sion Link Road) look the same as the slums (ZP) in central Dharavi.

Map 4. The formal city is depicted in detail, whereas slum is indicated with a uniform color and ZP (*zopadpattis*). Image is a composed detail from Mumbai City Map **(Eicher Goodearth, 2009).**

The formal status of an area can be of critical importance, as the people in Worli found out. The Bandra Worli Sealink is a motorway bridge spanning Mahim Bay. In the initial plans, the Sealink would make landfall at the tip of the Worli peninsula. In order to free the land for the new motorway, the neighborhood on the peninsula was categorized as slum and slated for demolition. Worli however is an ancient *koliwada* (fishermen village) and not a squatter settlement. Although the architecture of the *koliwada* is of informal character, the *kolis* hold formal title to the land. The inhabitants of Worli successfully fought for their rights and the Sealink now connects to a boulevard south of Worli.

Back to the UN-Habitat report, it reviewed definitions used by institutions involved with slum issues and drew up a list of attributes of slums:

- Lack of basic services.
- Substandard housing or illegal and inadequate building structures.
- Overcrowding and high density.
- Unhealthy living conditions and hazardous locations.
- Insecure tenure; irregular or informal settlements.

- Poverty and social exclusion.
- Minimum settlement size.[32]

Operational Definition of Slums

Eventually, the report presents an operational definition of slums as recommended by the UN Expert Group Meeting in Nairobi 2002, but restricted to the physical and legal characteristics of the settlement, and excluding the more difficult social dimensions:

> A slum is defined as an area that combines, to various extents, the following characteristics (UN-Habitat, 2003):
>
> - Inadequate access to safe water;
> - Inadequate access to sanitation and other infrastructure;
> - Poor structural quality of housing;
> - Overcrowding;
> - Insecure residential status.

In order to afford quantification by these indicators, the UN-Habitat report proposes thresholds values for slums. The threshold for overcrowding for example is set to two persons per room, or five m² per person. This threshold idea supports the notion that slums can indeed unslum, vice versa. The thresholds for the five characteristics mentioned above are given in Appendix 3: UN-Habitat Threshold Values for Slums.

Conclusions

Most of the characteristics attributed to slum deal with context, conditions, and status rather than with the dwelling itself. Similarly, the etymology of the word leads to the geology of the underground and even today slums typically sit in areas prone to flooding or landslides.

The operational definition by UN-Habitat affords quantitative research and enjoys support from many authors. Moreover, the use of so called 'thresholds' shows that slums can improve themselves and 'unslum', whereas it also shows that formal mass housing schemes are not the panacea, since it is possible they turn into slum themselves.

The term *informal settlement* mainly serves as political correct synonym for slum rather than as definition of it. At best, it implies that slums are settlements devoid of formality', which covers only one of the many indicators used by UN-Habitat. The Worli Koliwada example showed that formal status is not always visible in the physical world.

Slum is a quantifiable multidimensional quality.

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[32] A slum constitutes a distinct precinct and is not a single dwelling.

Incremental and Encroachment

One of the markers of slums is the incremental process by which it develops. It is like the organic growth of ancient cities, and unlike the readymade housing produced by the construction industry. A second marker is its unpredictable spread, i.e. how it encroaches on land for which the urban planners had different ideas. This chapter investigates the phenomena of incremental growth and encroachment in comparison with development in the formal sector.

Photo 174. Slums are marked by accretion of the affordable. April 19, 2013.

Incremental

In his search for what makes a building *alive*, Christopher Alexander distinguishes several properties of the process of creating life (Alexander, 2002d). One of them is the *structure preserving* nature of the process. With this, Alexander means that in nature everything builds on what already exists and that traces of a certain stage of development are recognizable in a later stage. An example is the growth of a single cell into a full-grown man. Perhaps embryonic development is the most illustrative part. It starts with a single cell and grows by multiplication, i.e. cells divide, grow, and divide again. This multiplication as such does not account for the diversity of cells and organs found in the human body. The gradual diversification takes place in a process of folding, division, and connection. At any moment in the process, it is clear how it relates to the previous stage. No structure comes out of nothing. In inorganic nature, this happens too. Crystals grow in a way one can recognize them as a certain mineral at any time. In a big crystal, the small crystal of the earlier stage is still present.

Slum dwellings develop in a similar way, as illustrated by Sonam Ambe's step-by-step typology (page 157).

Alexander distinguishes also a *generating* process from a *creating* process. The generating process is incremental and based on accretion, whereas the creative process is one of assembling items each having their own origin.

The link of incremental with informal can be understood from how industry and the formal sector are related. As discussed in Informal World (page 79), the formal sector makes use of legal entities, unlike the household enterprise that is owned by a natural person. Legal entities are formal constructs that afford the development of large industries. The scale by which such industries can grow is not possible in household enterprises, in which the assets of the owner are the limiting factor. One of the conditions for successful development in the formal sector is the willingness to engage in *creative destruction*, the process in which obsolete methods or habits are replaced with innovative ones (Acemoglu & Robinson, 2012). Typically, creative destruction is not in the nature of incremental development and the informal sector. In the informal sector, growth is mainly the result of accumulation, whereas in the formal sector the use of legal entities affords expansion in wait of returns. The term incremental thus also applies to finance and security of tenure.

Incremental development is not specifically a slum characteristic. Many buildings are adapted over time. Private houses change with the needs of the occupants. Rooms and floors are added, bathrooms enlarged.
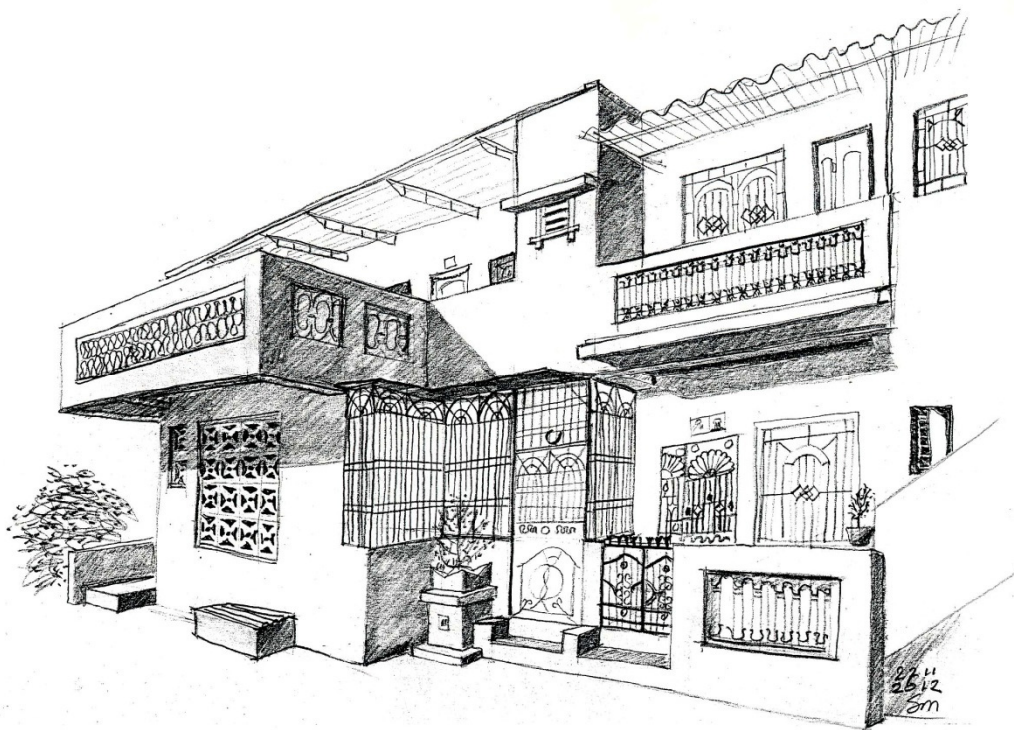
Drawing 30. These two houses in Vasind were built with identical façades whereas little of that remains visible today. The house on the left grew the most.

Photo 175. Extension of Jaipur. Incremental architecture in a planned (i.e. created) neighborhood. December 3, 2012.

Photo 176. Incremental development also occurs in quality. The façade of this Dharavi mansion is clad with glazed tiles. December 28, 2012.

Encroachment

Encroachment means: - to gradually take away someone else's rights, or to take control of someone's time, work, etcetera, or: - to gradually cover more and more of an area of land.[33] In the framework of this chapter, it means in short: appropriation of space that is not one's own. Encroachment can take several forms.

1. Encroachment on common space and public land.
2. Encroachment on someone else's property.
3. Informal extension on the roof, exceeding official height limits.
4. Building over of balconies, encroachment on quality space.
5. Annexation of public space by commercial activities.
6. Pavement dwelling. Shelters along streets built by squatters.
7. Fragmentation of living space. Subdivision of apartments into living space below the standards of subsistence.

One of the criticisms on slums is that it involves squatting on other people's property or public land. From the perspective of the informal sector however, land can also be common property. The formal sector preferably distinguishes between private and public, whereas much of vernacular is based on communal ownership. Slums are typically the areas where these two perceptions collide, and the collision is the notion of encroachment.

When starting a new settlement, the main issue is finding land. Finding genuinely vacant land in a city like Mumbai is impossible. All land is taken, and if not so, it is property of the state of Maharashtra or India. All new squatter settlement involves encroachment on already claimed land. Pavement dwelling is encroachment on the streets of the city. Although a street is often common space, in formal terms it is not, it is public space. This distinction between formal and informal makes all the difference. A municipality is the formal entity (legal person) that represents the community whereas a community is made of natural persons. In the perception of squatters, things may be right as long as neighbors (natural persons) agree, but the municipality finds itself backed by the government. Therefore, pavement dwelling as an encroachment strategy is a dead end.

Railway companies own an important part of the land in the city. As land along the tracks is often reserved for future expansion, large tracts look underutilized. In a situation where people are desperate for a place to settle, the reserved land is an easy prey. A railway company is an example of a legal entity, and encroachment on its land is a typical case of the informal sector meeting the formal. In Photo 177, the border of the railway land is not visible and the informal sector consequently regards it as

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[33] ("Cambridge English Dictionary & Thesaurus," n.d.)

common land. Apparently, there is an understanding that the land is wasteland, as the trench separates the clean and the dirty. In Photo 178, a wall with barbwire is the static border between railway land and slums. The boundary of the legal entity is a physical reality here. The use of the railway beds by launderers is temporary and not a permanent appropriation. Using Mehrotra's distinction (Mehrotra, 2009), this is *kinetic* encroachment.

Photo 177. The further away from the tracks, the more permanent the structures. Besides as space for huts, clotheslines, and playing children, the land serves as garbage dump. The streets in the slums are clean; the trench on the left is what dwellers consider the boundary of the wasteland. January 15, 2009.

Photo 178. A wall with barbwire separates the slums from the railway land, i.e. a physical boundary marks the formal boundary. Still, launderers use the railway beds for drying, which is an example of kinetic encroachment. January 4, 2013.

A typical *static* encroachment is building on land under high-tension lines. Building there is not permitted, but since the land affords little other intensive use, it is ideal for squatter settlement. Although settling is illegal, a certain degree of security comes from the fact that a power company has little to gain from clearing the area. As a result, the strip of land between Central Railway line and Mahatma Gandhi Road in Dharavi is a secure place. The main obstacles in development of the area however are the same high-tension lines, since they restrict building height to three floors.

Photo 179. Land under high-tension lines is usually taken for squatter settlement. The high-tension lines restrict building heights. January 19, 2013.

As shown in the above examples, encroachment takes place on wasteland, or land considered such by squatters. Dharavi once was no more than marshland, on which building was impossible. It only afforded use as dumping ground for Bombay's garbage. The dumping gradually turned the wasteland into buildable land. Thus, it is a thin line between wasteland and nature. The only wastelands found in Tokyo for example, are the riverbeds, of which major parts are already cemented over.

Photo 180. Informal settlement on the edge of nature and wasteland: the riverbed of Ara River in Tokyo. March 18, 2007.

Photo 181. Wasteland in the modern city: informal dwellings sit under Tokyo's Metropolitan Expressway, on the unsafe side of the wall that protects the city from the Sumida River. January 28, 2007.

Mumbai's Versova Beach is an example of encroachment into nature, i.e. into the sea. The informal and the formal sector meet here in an intricate way. Although an environmental protection program for coastal areas nowadays forbids new permanent construction closer than 500 meters to the water, many pockets of settlement still exist within reach of the waves. Versova is exposed directly to the Arabian Sea and houses are occasionally washed away in tropical storms. In order to protect people, local authorities order inhabitants to leave the houses that are most at risk and to seek shelter elsewhere. Since the settlement as such is informal and illegal, but dwellers are protected from eviction by law [34], authorities are forced to tolerate the erection of

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[34] The 1995 Slum Rehabilitation Act protects from eviction, those who can produce a document proving they lived in the city of Mumbai before January 1995.

temporary shelter on coastal land. In addition, eviction during monsoon is too much a burden on dwellers. Migrants use this legal loophole every year. On the beach therefore, one finds a seasonal presence of farmers. As a result, informal settlement in Versova Beach consists of two pockets: a permanent one with *pucca* houses and a seasonal *kacca* part made of tents. Those who lose their *pucca* home in a storm move to the neighboring *kacca* area until the end of the rainy season.

Photo 182. Encroachment on Versova Beach, unintentionally sanctioned by a combination of laws. The slums on the left are permanent, the tents on the right only seasonal. Image Google/DigitalGlobe.

Perhaps the form of encroachment most known in western societies is squatting in vacant buildings. It is an informal act comparable with finding shelter in an existing cave, but in conflict with the rules of the formal sector. Vacancy of buildings is part of how legal entities operate in the market. From a household perspective however, vacancy is unacceptable in times of housing shortage. This is another example of how encroachment is the collision of the formal and the informal.

The example of Versova Beach showed how nature puts limits to encroachment, as the sea takes whatever is too much. Encroachment on formal property is handled by the police, or in legal procedures.

An example comparable to the Torre David in Caracas is Kolya Khata[35] building (Photo 183) in Kuttiwadi Dharavi. It was developed by a contractor (i.e. a legal entity) who failed to finish it within the budget, and consequently went bankrupt. The unfinished eight floor concrete structure sits amidst the slums of Dharavi, where the demand for housing is enormous. Kolya Khata is open and has all the ingredients for massive squatting, but remains mostly empty. The structure exists in physical terms, but the formal structures that afford utilities and services are missing. Due to this absence of

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[35] Also discussed under Vertical Slum, page 296.

the formal part, the major part of the building cannot be encroached by the informal sector. Only the first and the second floor are appropriated.

Photo 183. Kolya Khata is a failed product of the formal sector. Since utilities and services are missing, squatters have only encroached on the first and second floor. The informal sector cannot handle the rest of the building. April 19, 2013.

Photo 184.The overhanging upper floor gives a slum dwelling its typical mushroom shape. April 19, 2013.

Encroachment also gives the slum dwelling its distinct appearance. Typically, the upper floor is bigger than the ground floor. People create extra floor space by making two to three foot wide overhangs where possible. The overhang also serves as awning and affords the use of a hatch as front door (see Stairs).The multistoried slum dwelling thus encroaches on overhead street space (Drawing 31).
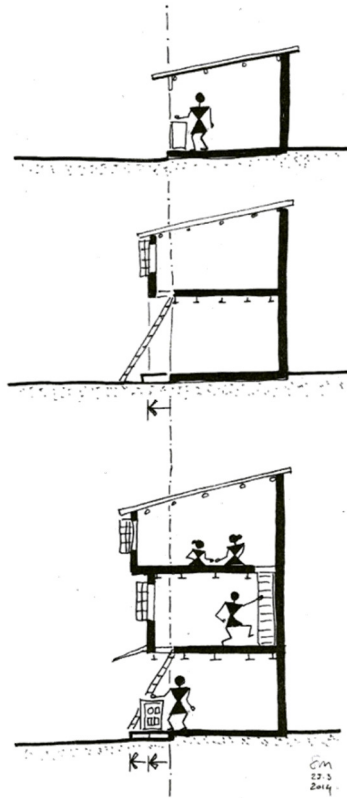
Drawing 31. Incremental development and its encroachment on the street.

Photo 185. Looking upward in a narrow alley. The overhangs come so close the window box grills almost touch and roofs actually overlap. Dharavi, January 17, 2013.

The overhangs are also built over narrow alleys, barely leaving distance between houses (Photo 185). The narrowness is detrimental to people's privacy, already one of the biggest issues for slum dwellers.

Photo 186. Stepwise encroachment on the street. Stairs and a small shop sit in front of the initial dwelling. January 21, 2013.

Photo 187. Encroachment on overhead space. April 10, 2013.

At street level, encroachment is just as common. Ladders to the first floor are placed in front of the house, on the street. Shopkeepers place there counters just outside the shop during the day, and take them back in at night. One day, they leave the counter, extend the walls on both sides a bit, and thus claim some extra ground (Drawing 31). It happens that municipal officials take action against encroachment. In Dharavi's Mahatma Gandhi Road for example, ladders are sometimes cut or parts of houses are demolished, all in order to clear the street. People restore the ladders as soon as the officials have left.

The continuous addition of stairs and vending booths (Photo 186) goes at the cost of street width. Besides authorities guarding this width, foremost car traffic limits encroachment. In narrower streets, encroachment is harder to stem, as pedestrians are 'softer' than cars (Photo 189). Other than in real slum, encroachment in Koliwada is clearly distinguishable from the initial fishermen's houses. Since streets in the old village had a certain generous width, unlike slum alleys, later additions seem alien. Encroachments look like tumors sitting to bigger houses (Photo 188).

Photo 188. A tailor's vending booth with workshop on top sits to a Koliwada house. March 17, 2008.

Photo 189. The tailor's shop encroachment is halving the initial width of the street. March 17, 2008.

Encroachment on Affordances

In the above, encroachment is explained as the occupation of land that is not one's own. As the dictionary description already suggests, there are several other forms of encroachment. Inside the dwelling for example, it is possible that one use encroaches on another. In Hong Kong, the construction of informal dwellings on rooftops is a widespread practice (Wu & Canham, 2009). In the chapter on Settled Dwelling, the evolution of *chawls* showed verandas converted into rooms. Similarly, the loft in Roof became inhabited in Pavement Dwelling. Living inside the loft is a form of encroachment, i.e. into the roof cavity. Where the pavement dwelling itself sits on the pavement, living as use encroaches on the street (Photo 55). Pavement dwelling as a whole is encroachment, as by definition it takes place on non-vacant land.

Kinetic Encroachment

Encroachment is an important playing field for shopkeepers. They take it to the limit with parapets, advertising, signage, and so on. Every extension possible is used to extend the dynamics of the shop to the street and to connect the street to the shop. The goal is to embrace the client in the street and drag him into the shop. Every opportunity is taken to improve the inviting qualities of the shop. The shop front, signage, racks, advertising, everything is being adapted continuously. It is a hot spot of symbiosis as the shopkeeper and his shop are constantly interacting. Most successful are those who manage to connect smoothly the private space of the shop to the public space of the street.

Photo 190. Shops pushing themselves into the street. Mumbai, January 24, 2010.

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The phenomenon is even more apparent when looking at the façade as a whole (Photo 190). Seen from the life in the street, the ground floor is where it all happens. The upper parts of the façade are of little importance compared to below, being the actual front. The same goes for the horizontal. The back of the shop is less active, as is the open area in the street. The shop front is the focus of activities, housing the life of the street. It illustrates the importance of the building edge[36] as hot spot of people building symbiosis. Note that the kinetic character is more present in the India example than in more formalized countries where this type of encroachment is highly restricted.

Discussion

Encroachment hinges on the notion of division. It is a transgression of formal boundaries dividing domains not as manifest in the natural world. These boundaries afford concepts like property, function, and formal regulations. The world of these divisions is the datascape as explained on page 75. The trend visible in the transition from vernacular to modern is that of sharpening divisions and therefore more manifest encroachment. In rural areas, one still finds common land that in formal terms is a kind of 'no-man's land' as it is neither public nor private. One day a household dumps its garbage there, whereas the next day the same people clean it in order to prepare for a celebration. This kinetic encroachment is increasingly becoming subject of regulation by the static city, eventually abandoning the notion of common space. The notion of encroachment relates to *pucca*fication in the sense of abstraction of the indoor-outdoor and hardening through formalization.

Whereas enforcement of zoning plans is a sensible restoration of formal space in the planned city, such actions are contradictory in informal settlement. Cutting ladders in Dharavi in order to halt encroachment therefore is not an act of enforcement, but the imposition of formality and datascape.

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[36] Building Edge is the notion in *A Pattern Language* (Alexander, 1977) that describes the life connection of the street and the building.

Slum Improvement

Informal settlement is a container term for all forms of settlement that are not part of the planned and formalized city. It covers squatter settlements, pavement dwellings, slums, *barrios, favelas, bidonvilles*, et cetera. In this thesis, informal settlement is the overflow of the planned city, when that city is not capable of absorbing migrants. Informal settlement is commonly considered undesirable in the planned city. Many a city therefore works on improvement schemes ranging from slum upgrading to replacing informal settlement with mass housing. Besides the improvement of living conditions as intended, redevelopment often comes with a considerable change of lifestyle. In investigating the transition from vernacular living to modern, these replacement schemes are the extreme cases, since they confront the residents with an acute move from one extreme to the other. This chapter investigates the phenomenon of 'rehousing the poor' and shows where the various strategies fit in the range from vernacular to commodity.

Photo 191. Slum-replacing high-rise of Nahar Amrit Shakti amidst informal settlement north of Asalpha Road, Mumbai. July 20, 2014.

One could fill a library of considerable size with all the publications about slum rehabilitation. The phenomenon is so big it inspired Mike Davis (2006) to the title of **PLANET OF SLUMS**. Davis gives an overview of the many programs carried out in the battle against poor living conditions. Davis presents an analysis of the course of events that led to the immense slum forming that took place in only a few decades time. In short, industrial development, which took more than a century in western countries, began later in developing countries but took a much faster track. Since development of

other parts of societies like administration and financial systems developed less rapidly than industry and its employment, the planning and construction of sufficient housing lagged more and more behind. The planned city is insufficiently capable of establishing itself. Consequently, many housing schemes have the character of rearguard action, and easily classify as failures, for example by Davis in his book.

Mumbai's Housing Situation in the 20th Century

In the case of Mumbai, the city's inability to absorb migrants is linked to a persistent housing shortage, partly caused by the 1947 Bombay Rent Act (Padmenabhan, 1998; S. B. Patel, 2005). In order to curb inflation, this act capped rents in Maharashtra to the standard rent of 1940. The Rent Act was a temporary provision, but was extended repeatedly until 1998. The Bombay Rent Act could live that long because of an electoral gridlock. The so-called *frozen rent tenants* made a considerable portion of the voters, and most politicians could not afford being against another extension of the Rent Act although they were aware of its devastating effects. The Rent Act therefore only ended in 1998 by a Supreme Court ruling and not by government decision. By that time, rents lagged almost sixty years behind real costs. Property owners obviously could not afford maintenance or repairs. As a result, many buildings ran down or even collapsed. Moreover, since the returns were little, investing in new housing became unattractive. Effectively, the market for rental housing came to a halt and whatever was built, was mainly for owner occupation (S. B. Patel, 2005). Although the rent Act only applied to pre-1947 buildings, later tenant protecting measures had similar effects.

Another obstacle in the production of housing was the Urban Land (Ceiling and Regulation) Act, 1976, intended to free up land held by a few persons for speculation. It put a maximum to the amount of land that one person could own; excess land had to be sold. The act however backfired and had a considerable bearing on urban development. The Maharashtra state government repealed it in 2007.

Under these obstacles however, lies a paradoxical case of city planning that eventually led to slum forming. In the mid twentieth century, the municipality had indeed reserved land for various amenities like schools, parks, and hospitals. The development of these amenities however never took place. At the same time, private owners kept vast tracts of land vacant in the hope to make money when prices would rise. In this context of plenty of vacant land and severe housing shortage, it was inevitable that thousands of people with jobs but nowhere to live took the initiative and created their own housing. Gradually, much of the vacant land turned into slums.

Types and Origin of Slums in Mumbai

Slum forming is the result of mass migration into the city combined with short supply of housing. Migrants create their own shelter on whatever land available and do this in a vernacular way. Similar to the home village described in the chapter about Street,

dwellings are built close to each other. An important difference however is the surrounding land. In the countryside, agricultural land around the village has a thinning effect on the overall population density. Space needed for food production for example, is not calculated in urban density figures since in the city this open land is not available. As a result, slums as urbanized area are densely populated, although their mean household size of 4.8 is lower than the 5.1 of urban and 5.3 of rural India ("Census of India," 2011). In Mumbai slums, the mean household size is 4.5 (Census survey of 2001 cited in (MCGM, n.d.)). Besides building houses close to each other over a large area without intermitting open space, a second densifying effect comes from stacking dwellings. With the introduction of the reinforced-concrete slab, it became possible to develop houses incrementally in an economic way (see chapter on *Kacca* and *Pucca*. As a roof slab is also a floor, vertical extension is the logical next step.

The two factors combined result in densely built land, leaving little space for the development of planned public housing. Replacing informal settlements requires a strategy for the logistics of removing settlers to a temporary location, clearing the land, building new housing, and relocating the settlers into the new building. These complicated logistics are emblematic of post planning redevelopment. This moving around makes the transition stressful for residents.

Housing forms for the poor are: (1) Pavement dwellings, (2) *Zopadpattis* (squatter housing) or slum dwellings, and (3) *Chawls* and *Patra Chawls*.

Pavement dwellings are shanties built on sidewalks along roads. They do not fall under the legal definition[37] of 'slum'. In general, living conditions in these dwellings are worse than in slum dwellings. Pavement dwellers see themselves often confronted with evictions and harassment. In addition, the dwellers are not eligible for government-led improvement schemes.

Zopadpattis or squatter housing is the predominant form of slum dwellings. The Greater Mumbai City Development Plan 2005 to 2025 (MCGM, n.d.) describes them as essentially poor neighborhood areas or "blights". Although squatting began already before 1947, it was not before the early 1990s that a separate governmental body, the Slum Redevelopment Authority (SRA), was created to address the problem. The 2001 Census survey identified a slum population of 6.25 million, which is about 54% of the total population of Mumbai.

Chawls (described on page 157) were meant for male migrants to the city but were gradually occupied by families. Consequently, household sizes increased considerably. The rent freezes caused by the Rent Control Act led to overdue maintenance and eventually to deterioration of the structures. Although *chawls* do not fall under the legal definition of 'slum,' their generally poor state puts them in the scope of low-

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[37] " 'Slum areas' means any area declared as such by the Competent Authority [...] appointed by [Maharashtra] State Government" ("Maharashtra Slum Areas Act," 1971).

income housing improvement schemes. Moreover, (UN-Habitat, 2003) in a discussion of the term slum, lists *chawl* under 'equivalent words in other languages.'

As former bureaucrat J.B. D'Souza points out (Hollick, 2011), city planners when thinking of housing for workers, would have unionized industries in mind, just like *chawls* were built for factory and mill workers. Many other migrants to the city however were not employed by the industry and had no other option than to turn to informal settlement. Thus, many who worked in small businesses ended up in pavement dwelling.

Types of Rehabilitation

Various schemes tried to tackle the housing shortage and to improve the living conditions of the poor. In its Greater Mumbai City Development Plan 2005 to 2025 (MCGM, n.d.), the BMC[38] makes mention of two main *actions for housing access to slums*: one based on participatory development, the other on commercial development. Participatory development aims at stimulating development by residents and communities themselves. It involves granting tenure to residents who not yet formally own what they occupy. The purpose of tenure grant is to allow owners choice and thus unlock the market value of their assets, a mechanism explained in De Soto's MYSTERY OF CAPITAL (2000). The Charles Correa-lead committee that worked on how to redevelop Dharavi, following the Prime Minister's Grant Project, already recommended tenure grant for inhabitants in 1986.

Slum Redevelopment Programs

The commercial option of slum rehabilitation is facilitated by the Slum Redevelopment Scheme (SRD) and the later Slum Rehabilitation Scheme (SRS) in which the developer (and this could be an NGO, a community, builders or a construction company) creates new housing for the present[39] slum dwellers. The financial part of projects involves a system of cross-subsidization. Slum dwellers are relocated in multi-storied buildings on one part of the land while the other part is sold at commercial rates. On the latter, high-end apartments and offices can be developed (Photo 193). This way, the poor can obtain housing at low (or even no) costs, while developers can make profit from the project as a whole. In case the area is too small to accommodate both the poor and the profitable, the rights for developing the commercial part can be used elsewhere in Mumbai, in a system of Transferable Development Rights (TDR). The Slum Redevelopment Scheme only applies to state government land, not to central government land.

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[38] The Municipal Corporation of Greater Mumbai (MCGM) is commonly known as the Brihanmumbai Municipal Corporation (BMC)

[39] In order to be recognized as 'present slum dweller' one faces the conundrum of having to produce *formal* proof of residence in a given *informal* settlement (!).

Photo 192. Slum rehabilitation in Andheri West, Mumbai. February 2, 2010.

The 1991 SRD facilitated private sector participation through the above-mentioned cross-subsidization of granting an increased FSI of 2.5 in exchange for tenements for slum dwellers, who were given a 180 sqft (16.7 m²) tenement per family on a thirty-year lease and on the condition that tenements could not be transferred in the first ten years. In addition, an own contribution from slum dwellers was required, of which one third to be paid up-front, the remainder to be paid in installments. The scheme also required that at least 70% of the families agreed to participate in the project and that a cooperative be established.

The later SRS advanced over the SRD and included all whom were eligible according to the 1995 Slum Rehabilitation Act[40], i.e. whose names appeared on the electoral role of 1995. Other incentives introduced were the increase of the tenements to 225 sqft (21 m²), the abolition of the own contribution (i.e. tenements were to be given free of cost), and the introduction of the Transferable Development Rights (TDR) for surplus floor area. Still, slum dwellers living in dwellings of more than 225 sqft for obvious reasons were reluctant to participate. Some of them occupied dwellings of 500 sqft with a big family. In SHADOW CITIES, Robert Neuwirth (2005) points out some other catches that make the scheme less brilliant in practice than it looked on paper. On the side of development, it connected (and therefore subjected) 'building for the poor' to the whims of the real estate market. As prices fell drastically in the late 1990s, the high-

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[40] The 1995 Slum Rehabilitation Act protects from eviction, those who can produce a document proving they lived in the city of Mumbai before January 1995.

end housing part of projects often yielded too little to allow profitable use of the scheme. On the side of residents, it created a problem for those who were renting a slum dwelling. Generally, those eligible for the SRD and SRS have a long residential history. They have moved upward in the local economy, i.e. rent out the floors they built on top of their own dwelling. The tenants however, are often not eligible for the schemes due to lack of residential history.

The evolution from SRD to SRS is typical of the transition from vernacular to commercial. First, the construction of informal settlement in the city is a continuation of the vernacular practice in the countryside. Then, dwellers enter in the world of formalization and rights. The combination of occupying land and protection from eviction becomes their main asset. In the SRD, present dwellers capitalize on this asset in order to become eligible for the scheme. Still they have to pay for the housing, i.e. they trade their right for *access*. In the SRS, present dwellers capitalize on their right in order to acquire a tenement, i.e. they trade their rights for *asset*. The SRS therefore is a scheme in which capitalization (by all parties) goes much further than in the SRD. In the SRS, dwellers are catapulted from the vernacular world into capitalism. The abolition of the own contribution has put the 'tenants' in a position best described by today's 'big data' maxim: 'If it's free, you're the product.' Whereas in the SRD residents were part of the long-term financial equation, the SRS eliminated their stake (and with it, all their commitment to keeping up a habitable building).

Photo 193. Babasaheb Ambedkar Nagar, Parel, Mumbai. Four blocks of low cost housing for former slum dwellers, flanked by high-end apartment blocks on the left and office high-rise (under construction). January 21, 2010.

In order to make SRS projects profitable, the low cost housing must be built in high densities. Without hesitation, developers take the legal *minimum* size of 225 sqft per condominium as the *maximum,* and build housing blocks at the smallest distance possible. As is normal in commercial conditions, profit gets priority over the interests of tenants. In the SRS scheme however, residents are not even tenants.

Blocks of GF+15 are built only 15 feet apart. Dwellings in the center of such three dimensional compounds receive little daylight and almost no natural ventilation. There is a resemblance between this kind of housing and Hong Kong's former Kowloon Walled City. Building high-rise blocks so close to each other make the cure worse than the disease. In addition, such no-revenue projects come with a standard lack of maintenance and thus pauperize in short time. Living on one of the higher floors is a good choice when it comes to enjoying daylight and fresh air, but will inevitably turn out troublesome as elevators suffer from power cuts and lack of maintenance. For this reason, it is recommended not to build higher than GF+4 for low-income housing. Buildings like in Photo 193 easily classify as vertical slums. Kamu Iyer points out that for the slum dweller, redevelopment is a reprieve from the threat of eviction although the tradeoff is the loss of light, air, and fire safety (Iyer, 2014).

This scheme works well in the sense that it is indeed producing some housing for the poor that otherwise would not be built. By creating lots of floor area (the essence of high-rise building), it is possible to reach the legally required minimum for living space per dwelling. Still, the density in terms of *land* per capita is problematic. Amenities such as infrastructure, transport, commerce, schools, utilities, and qualities like daylight and fresh air are over utilized.

The system of cross-subsidization is introduced in order to minimize the burden on government budgets. Despite its intention of helping the poor with low cost housing, it inevitably contributes to the disparity in living conditions of the rich and the poor. In order to make the scheme work, the costs (and therefore the quality) of the housing for the poor must be kept as low as possible. Mass production and standard design make this possible. Since the poor make no financial contribution to the project, they have no influence on the design of the product, which is typical of a supply driven approach.

It happens that residents of rehabilitation projects sell their condominium and move back to the slums. It is a practice often frowned upon since in cases where the new housing was free, selling it out is easily seen as a way to make money. The government interpreted these moves as a general preference of people to live in informal settlement rather than in a formalized setting, but did not consider that the type of housing was not appropriate (Sharma, 2000). The case of Mahila Milan, as will be discussed below, shows that the inadequate design of the condominiums makes people want to leave. The potential profit is merely an additional incentive to make the move. Besides that, a shelter in a slum has to be paid for too and moving there is not necessarily profitable. Nevertheless, the fact that people can make money of such a move is an indicator of a

flaw in the scheme: the free of cost housing comes with a paradoxical incentive to leave. Bhau Korde, a distinguished social activist in Dharavi, argues[41] that the practice of giving free housing to the poor is actually fueling the housing crisis. In his view, the design of housing should focus on how to keep people in their place and connected with other local people. Most plans are made for the short term, not for long-term solutions. Korde sees that development is business, for money, not for people. All solutions so far tend to spoil people. This means subsidies should only be applied in a very precise way. People themselves should contribute too, in order to forge a connection with the place. In the light of the transition from vernacular to commercial, Korde's observations fit with the pattern that vernacular is about 'owning' the place, whereas commercial is about disconnection. According to Korde we should ask ourselves, "Are we helping people or are we spoiling them?" This 'spoiling' refers to the lack of commitment that results from providing something free of cost, effort, or struggle. In analogy with Habraken's "to dwell is to build" (Habraken, 1999), contribution helps people connect to a place, whereas free housing does not. Paraphrasing 'if it is free, you are the product', one could say, 'if it is free, it will not be yours'.

In addition, experiences of slum dwellers who participated in schemes for which they were relocated in outlying parts of the city have shown that the tenements were either taken by others who forced the eligible to leave, or the distance to their work had increased so much that returning to the city center became the better option (SPARC, 1985). Therefore, the financial profit of selling a tenement one has acquired free of cost, is not necessarily the most important factor.

The problem of the distance to work is typical of the transition from vernacular to modern times. The segregation of the city into residential, industrial, and other functions is highly dependent of mobility. Motorized transport was an essential ingredient already of the Garden City and *La Ville Radieuse*. Redevelopment schemes do normally not include affordable transportation for the poor, which makes the move into modern housing more complicated for them. As is shown in the census on pavement dwelling (SPARC, 1985), two third of the respondents said their current location was deliberately chosen close to where they work, since they could ill-afford the costs of transportation. Kalpana Sharma (2000) argues that many slum improvement schemes actually failed because they did not include affordable public transport.

Besides the costs of commuting by transit, there is a physical limitation as well. Mumbai's public transport is already loaded beyond its capacity and cannot take more commuters.

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[41] In interview with SdM on November 11, 2012.

Going from the world of living in ground-bound dwellings to the world of modern high-rise comes with several changes.

– Neighborliness making place for individuality and anonymity.
– The introduction of designated circulation space, which barely affords social contacts.
– Increase of the distance between home and work.
– Formal systems replacing informal practices.
– Exchange of rights for economic assets.
– The layout of the homes reflecting the change from fulfilling a demand to supplying a 'one size fits all'.

The consequences of people leaving rehabilitation projects are described by Jane Jacobs (1961) as the phenomenon of perpetual slum in which a high turnover of residents is typical. In order to un-slum, it is important that people stay and help build the community. People who intend to leave no longer contribute to neighborhood life. Newcomers, who do not yet have a network, also contribute little. Building community mainly comes from people who are dedicated and live in the area for already some time. The design of housing therefore should indeed focus on how to keep people in their place, which inevitably means having to listen to demands. As we have seen however, this rehabilitation housing is based on a supply driven approach, not demand driven.

Critique similar to Bhau Korde's comes from Mustansir Dalvi[42], who argues that redevelopment is the latest form of land reclamation[43]. Normally, a government can make money by selling or leasing out land, and land reclamation yields new. Land reclamation is also possible in a virtual form. Granting higher FSI, which only the government has the power to, creates space for new building. Dalvi points out that developers are the government's customers and that slum redevelopment authorities describe slum in a way that invites politicians to eradicate 'difficult areas.' Thus, the ambition of a 'slum free Mumbai in 2020' is an excuse for further land reclamation. Like Korde, Dalvi points out that developers do not aim at keeping people in their place but the contrary; by displacing people they destroy their network and thus free land for the production of more floor area. Contrary to the ambition to offer a decent place to live, rehabilitation is shifting people away.

Private Redevelopment

An example of private redevelopment is the Rajgir Sadan building, built on the place where Bhau Korde used to live in a chawl. He now lives on the fifth floor in Rajgir

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[42] Mustansir Dalvi is Professor of Architecture at Sir J.J. College of Architecture in Mumbai and affiliated with IIT Mumbai.
[43] In interview with SdM on January 2, 2012.

Sadan. The building was erected with government subsidy. The former chawl dwellers now live free of cost in condominiums. Some sold their condominium and moved.

An essential difference with the TDR rehabilitation scheme is the legal position of the initial occupants. In private redevelopment, occupants have security of tenure i.e. they own or rent the building or the land. Their status as owner/tenant is formalized and secured by the legal system. The tenure gives them the leverage to obtain a condominium of better or at least equal quality as the dwelling they sold. In the SRS/TDR scheme, the slum dwellers do not have this tenure. Their position is based on the 1995 Maharashtra Slum Rehabilitation Act[44] by which protects them from eviction. As a result, a developer has the obligation to provide housing for the people displaced by the project.

Site & Services

The case of Mumbai is an example of vernacular meeting urbanity. Vernacular, in the form of informal settlement, penetrated the swelling city in order to meet the demand for housing. This was partly made possible by the Bombay Rent Act, which kept modernity, capitalism, and mass housing at bay. Seemingly unaware of the fact that the Rent Act was hindering the professionalized creation of housing, the authorities tried to stem the flood of informal settlement by means of eviction and demolition. In a sense, they tried to stop vernacular construction, whereas they had almost brought market-based construction to a standstill too. In this context of stagnation, several development schemes were tried-out. Among them was the Site & Services scheme, which allowed people to buy a plot of land to which the municipality provided utilities and infrastructure. Next, the owner could develop a house by himself. Christopher Benninger developed the idea for this scheme in 1972. The aim was to bring housing within the paying capacity of the urban poor. SPARC founder Sheela Patel however observed that Site & Services did not reach the very poor since they lack an asset to start with (S. Patel, 2013).

The Site & Services strategy is a combination of two ideas. First, securing property rights allows people to capitalize their assets (de Soto, 2000) and second, housing construction by owner-builders is more effective and cost-efficient than the construction industry (Grindley, 1972; Turner, 1976). Several characteristics were essential to the success of the scheme. First, it allowed vernacular construction and thus recognized the status quo. Second, it by-passed the gridlock of the Bombay Rent Act and third, the Site & Services concept tapped directly into people's most powerful asset: creativity (de Maat, 2014).

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[44] The 1995 Slum Rehabilitation Act protects from eviction, those who can produce a document proving they lived in the city of Mumbai before January 1995, regardless of the type of municipal land, i.e. including pavement dwellers.

Mahila Milan, NSDF, and SPARC

Although pavement dwellings are not officially slum, a program aims at rehousing those who find themselves at the lowest step of the housing ladder.

In 1986, pavement dwellers from five neighborhoods in Mumbai's Byculla area came together to discuss ideas to improve their housing situation. The main problem they were facing was an ongoing cycle of eviction, demolition, and rebuilding of their huts. The practice of evicting pavement dwellers culminated in massive demolitions and deportations in July 1981, which inspired journalists and civil rights groups to file a petition in the Bombay High Court. Four years of legal seesaw followed. In July 1985, the Supreme Court judged the evictions were legal but that prior notice should be given to those affected. In addition, demolitions had to be carried out in a humane manner, i.e. not during monsoon. Nevertheless, demolitions could go on.

With the help of SPARC[45], a group of women pavement dwellers organized themselves under the name of *Mahila Milan*, Women Together. They realized that only through organizing themselves, they would be able to negotiate a way out of the situation. A year after the first women united in *Mahila Milan*, when slum dweller activist Arputham Jockin of the NSDF[46] suggested joining forces, an alliance of SPARC, MM, and NSDF was forged. The following paragraphs will show that the projects of the alliance are marked by an approach that is vernacular according Illich's definition.

In pavement dwellings, like in all India, women traditionally are most at home and consequently suffer the worst from evictions. Therefore, the alliance identified women as the major stakeholders. In addition, the women are often in charge of the household's money and women take a central position in the management of the household. For SPARC, MM, and NSDF alike, women are the key partners. Jockin points out[47] that India is a male represented country, but not male dominated. Men are leaders and representatives, whereas women are more fine-tuned on what works. In practice, the women arrange things in the name of the men. MM has a separate space in NSDF in order to avoid potential male domination.

In the early days, Mahila Milan facilitated a 'housing training' for pavement dwellers. It covered the handling of demolitions and safeguarding of belongings, prevention of future demolitions and assertion of the right to be notified in advance, community organization, and how to go to government offices. In a sense, this housing training was about dealing with the formalized city. If the city was not that apparently hostile, the training could be about 'how to live modern' or 'how to make the transition.'

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[45] Society for Promotion of Area Resource Centres.

[46] National Slum Dwellers Federation, founded in 1974 by Arputham Jockin who saw that the vulnerability of slum dwellers is due to their lack of organization.

[47] In interview with SdM on July 24, 2014.

As a way to stabilize their households, the women set up a communal savings system. The aim was to build the necessary financial reserve for the creation of proper housing. In the margin, women could also take small loans. The interest received from the loans is only used to cover the expenses of the organization and can thus be kept low.

In 1987, MM organized a House Model exhibition. People in various neighborhoods collectively designed houses and submitted their 1:1 scale model made of bamboo and cloth to the exhibition in Byculla, including furniture and kitchen utensils. They also displayed on measurements and building costs. Representatives from the participating neighborhoods could than vote for the best design. Professional architects estimated the building costs to be half of government-built housing (Hollick, 2011), a finding similar to what William Grindley (1972) saw in the US. The House Model Exhibition served several purposes, one of them showing to people from authorities like BMC and World Bank what the women actually wanted and how it related to the logic of their way of living. From the talks with authorities, the women learned that acquiring land would take a lot of time. The challenge for MM and SPARC shifted towards keeping the spirit up, and keeping all women on board. The saving system played a pivotal role in this exercise in perseverance.
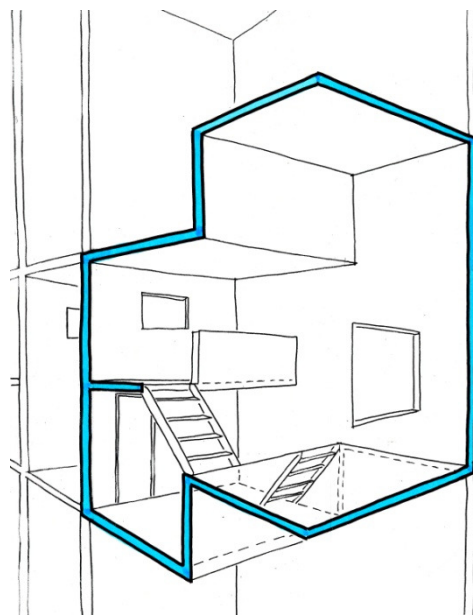
Drawing 32. Tenement developed by pavement dwellers and SPARC, built as Milan Nagar in Mankhurd Mumbai.

Next, housing projects were set up in which the women could invest their money in their own tenement. The women, in collaboration with engineers, made the design of the tenements. Thus, the project was based on what people actually wanted; it had to fit with their budget; and should comply with building codes. Moreover, the unsuitable designs typical of mass housing were avoided. An important reason for people to move out of the tenements built by developers was their inadequate design. However, uniformity in the layout of the tenements was necessary, as for example piping and

load bearing walls have to follow certain paths. Nevertheless, the design is primarily derived from the best practices of the household, less from industrial production. The combined design efforts led to a split-level tenement as shown in Drawing 32. Its floor space is 225 sqft, whereas the floor-to-floor height is 14 feet.

Like in SRD and SRS, the government supplies the land, on which the dwellers and the alliance can built their projects. It became clear however, that from the residents' perspectives at least, these projects worked better than those built by commercial developers in the SRS scheme. The government therefore (!) put restrictions on these people-managed projects by allowing only 225 sqft of floor space and a maximum height of 9 feet. Until the 1970s, maximum building height had been 14 feet, which was just enough to build a mezzanine floor in a dwelling. The 9 feet restriction hindered future changes. The alliance negotiated it back to 14 feet. According to SPARC founder Sheela Patel, the government imposes these restrictions in order to mask the deficiencies of other projects and the SRS. The government's policy of imposing the legal *minimum* as the *maximum* is similar to the earlier-mentioned practice applied by commercial developers.

The financial systems of the poor are fundamentally different from regular banking. Access to credit is an important barrier to the possibility for slum dwellers to raise money for housing since regular banks require a secured job or an asset as collateral to facilitate credit. Dalvi argues that banks do not know how to deal with the poor, as they do not understand the needs of the poor. Consequently, the poor pay the improvements they make on their dwellings mostly from their own savings. This is in line with the alliance's practice of setting up saving schemes. Jockin explained that a fundamental difference with the formal banking system lies in where the money is saved from. In the formal sector, people save from their income, whereas in the informal sector people save from expenditure. They plan their expenses and save the leftover.

Dalvi explained that in regular finance, investments in real estate are not depreciated which is why a building can be used as collateral. Since informal settlements often lack security of tenure, depreciation is inevitable. Investing savings actually affords this depreciation, whereas investment from loans does not. As a result, recycling of buildings, as is common in the western world, is not necessary. Demolition of obsolete buildings is easier, and considered a form of taking care of the social context. The western model does not recognize depreciation, almost as if everything is built to exist forever.

This model of depreciation works well in the case of Dharavi where practically everything is allowed be it with the threat of demolition. This demolition however, will never take place. Investment for the longer term is therefore relatively safe, but still goes with frequent renewal. People take care of their houses intensely.

Coping with risks is part of everyday life in the informal sector. People are used to it and therefore more ready to take risks. According to Jockin, insurance systems do not know how to deal with the demands of the informal. In formalized economies, insurances cover risks and people will only take a certain risk when they know it is insured. Switzerland with its insurance industry is emblematic of this. It is the same pattern as in credit supply; once one has entered formality, one can enjoy the production of capital and take bigger risks. This means that for informal dwellers, participating in contracted high-rise is highly stressful, as they have to put entire savings at risk. An important instrument people have in the informal financial system is trust. Since builders and clients are part of the same social network, they are subject to forced integrity. In case of dispute, they cannot escape from each other.

In Situ Upgrading

The landscape of Dharavi is permanently changing. Informal settlements become upgraded houses in a process of incremental development. End-users change and adapt their environment directly in a natural process. Thus, it will deal with the issue of high densities as well. Many downtown cities in the world have evolved by this process. The crucial thing is this process cannot be hastened.

Probably, the subtlety of this generating process leaves many still to use the word *slum* for areas that have in fact improved beyond the poor early stage. Moreover, this process is spatially intertwined and gradual in time, making it harder to distinguish and appreciate the qualities of incremental development.

Photo 194. Incremental development (left) and planned redevelopment (high-rise). Dharavi, January 26, 2010.

In **Incremental Housing and Cumulative Growth Patterns,** Sonam Ambe (2013) describes the incremental process by which slum dwellers improve their housing. Ambe distinguishes several stages, which she calls 'moments.' A detailed description of the architecture of each of these Moments is already given in chapter Settled Dwelling (page 157). The below will discuss these Moments again in order to link them to the economics of slum improvement.

Moment 1: The Settling
After finding a suitable piece of land, a structure of bamboo poles and plastic tarpaulins is set up.

Moment 2: The Hesitation
The hesitation to improve the dwelling is caused by the lack of security of tenure and by potential eviction. People are reluctant to invest in their dwelling under such risky conditions. Since the insecurity of tenure can last for a long time, the hesitation phase is potentially infinite.

Moment 3: Towards *Pucca* Permanence
Once residents have more security, they are willing to invest in *pucca* materials, e.g. bricks, mortar, paint et cetera. The choice of materials much depends on the dwellers' spending power and the sense of security. Even when the land is occupied illegally, a certain degree of security of tenure can be reached through elections. It is easy to buy votes with the promise not to evict.

Moment + : The Community and services
Changes that take place *around* the dwelling are the markers of this additional moment. The introduction of pavement and other communal provisions contribute to the sense of permanence and security of tenure. When a municipality makes such investments, dwellers see it as a form of recognition.

Moment 4: The Stack
On a *pucca* house, it is possible to have a concrete roof, which can serve as floor for a next story. Thus, dwellings can be stacked and vertically extended. Stacked dwellings are not necessarily fully *pucca*. One finds Moment 3 ground floor structures with a Moment 2 dwelling on top.

Moment 5: The Mansion
Further extension and improvement involves full replacement of the stacked dwellings by one comprehensive *pucca* structure. This moment is identical to upgrading in other areas than informal settlement. Note that this full replacement is a demonstration of the depreciation model as explained by Mustansir Dalvi, earlier in this chapter.

In order to map these moments, Ambe distinguishes four domains of accumulation:

Financial Accumulation	Functional Accumulation
Material Accumulation	Structural Accumulation (Space and Volume)

In moments 1 and 2, investing money is risky and the main visible accumulation is that of material. Much of accumulation occurs in preparation for moment 3, when security of tenure provides a springboard for consolidation. Moment 4 (The Stack) is the next springboard as the added story is mostly rented out and creates considerable additional income. This increase of income eventually affords the step towards moment 5, which requires the demolition of what was built in the earlier moments. The functional accumulation is visible in the attribution of functions to designated areas in the home. As argued in the chapter about Furniture, functionalism is a segregation of use into functions. Functional accumulation therefore is diversification rather than growth.

Following Illich's definition of vernacular, i.e. vernacular as a product of the household not produced for the market; moment 4 is the watershed between vernacular and commodity. The rentable top floor is indeed a commodity. In addition, the process until moment 4 is of a generative nature, whereas step 5 is typically creation.

Transition Process

From Vernacular …

Migrants' home villages are often of more vernacular character. The architecture is vernacular and indeed produced on basis of demand, with the help of family and community. The demand for construction often comes from social changes, such as marriages and births. Extension of the family is an extension of the home. For example, when a couple gets married, the bride usually moves to the home of the groom's family, which may be a reason to add another room for the couple. Much of traditional rural architecture is based on the joint family format.

As we have seen above, for those who migrated to Mumbai, it was unlikely to find proper urban housing. While cities around the world were producing mass housing, the Bombay Rent Act and other factors prevented its coming to Mumbai, making Mumbai a city where mainly vernacular strategies could prosper. Migrants often had only one option: to build their own shelter on whatever piece of land available, for which they used their common, vernacular, methods. The result is informal settlement.

Despite the link with vernacular methods, the look of informal settlement is very different from traditional rural architecture. Developers who see business opportunities often call it ugly, blights, eyesores, and the like. This difference in look is mainly due to two factors: different materials and higher density. Just like materials come from the *natural* jungle in rural settings, materials in the city are taken from the *urban* jungle. The readily available materials in the city are those coming from recycling, and have their origin in industrial production. Urban density, the second factor, is of course much higher than in the countryside. As a result, many uses are collapsed into small spaces. Close observation however shows that many coping

strategies regarding high densities have their origin in the social structures, patterns, and behavior found in the countryside.

... to Mass Housing

The architecture of the planned city, and mass housing in particular, is of a different nature. Rental housing for example, is produced without actual involvement of the occupants. It is built for the market in a supply driven manner. As long as there are people willing to fit their family into the housing as supplied, it can be rented out. Mass housing discovered that dwelling is a *thing* that can be treated as a commodity (Habraken, 1999). An easy fit is the nuclear family, since it allows standardization best and is commercially the most profitable. Migration to the city therefore comes with changes in the format of families, e.g. when a nuclear family splits off from a joint family in order to move to a condominium. The impact of such a split-off can be thus severe, that people plan to return to their hometown in order to restore the joint family[48]. Dr. Deelip Kadam, a friend of Bhau Korde, observes that families establish new networks in the form of building coalitions and societies[49].

The daily life in joint families makes people more skilled in negotiating privacy and crowding. Empathy and sense of solidarity are stronger among those coming from a rural community compared to people who are used to living as a nuclear family in a condominium. In rural homes, privacy is found in the jungle. The house itself is a place of company and getting together. In urban informal settlement, one finds the same patterns.

Transit Camps

Replacing informal settlements with professionalized housing requires a strategy for the logistics of removing settlers to a temporary location, building new housing, and relocating the settlers into the new building. The temporary locations are known as transit camps. Some look like stacked cabins; others mimic apartment blocks. It does happen though that transit camps become the permanent housing of the displaced.

Transition Side Effects

Many of these schemes consist of replacing informal settlement by high-rise mass housing. Such replacements are a sharp turn from vernacular to commercial. Besides the clear transition in architecture, a radical change in the social takes place as well. Nuclear families split off from joint families, and the use of homes is reduced to the single purpose of living. Mixed uses with small enterprises and commerce are not possible in high-rise. The interstice between living and livelihood increases drastically. This transition is even more acute since it takes place on people's doorstep.

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[48] For example the Patel family, in interview with SdM on November 22, 2012.

[49] In interview with SdM on January 5, 2012.

Photo 195. Stages of redevelopment: slum on the right, transit camp on the left, construction and relocation in the background. Andheri West, Mumbai, February 2, 2010.

Photo 196. Temporary Transit Camp in 90 Feet Road Dharavi, built by the Slum Redevelopment Authority (SRA). August 6, 2014.

Redevelopment projects in Dharavi Mumbai for example meet a lot of resistance from people who prefer to live on the ground and not 'up there.' It is not uncommon to see people participate in a redevelopment scheme, give up their slum dwelling and move to a condominium, and return some time later to the informal settlements below. When asked about the motives for this move, the common answer is the disconnection from social life they experienced after moving to so-many floors above. People feel cut off from family and friends. Shared spaces like corridors, staircases, and elevators are

not perceived as communal space, mainly because they only afford circulation. Some people encourage their neighbors on the same floor to leave their front door open when at home, in order to create at least some sense of community. These interstice spaces are typical of modern buildings and are rare in vernacular environments. It may sound strange to outsiders, but many Dharavians flatly do not want to leave the slums. The social connections are stronger than the physical inconveniences, and much of the quality of life in slums comes from the social part.

Mass housing is marked by divisions into: its production, its social aspects, and its physical appearance. The division of labor is typical of industrial production. Social division and segregation easily occur in a monoculture of use (living) and family format (nuclear). We know from Jane Jacobs (1961) that diversity and sufficient density are essential in creating coherent cities. The physical division is visible through the amount of material and space needed to connect all the separate elements. In multistoried buildings for example, corridors, halls, staircases, and elevators take a considerable amount of space (Drawing 33). In vernacular environments, circulation space is shared with other uses like socializing, vending, and play.

Drawing 33. In Rajgir Sadan, the hall (blue) typically does not afford the ordinary social life found in the street. This kind of single purpose circulation space is found inside the tenements as well (green).

With the earlier-mentioned 'The focus should be on connection with the place and other people', Korde points out a similar problem typical of multi-storied building. Hallways that connect apartments, elevators, and staircases, do not afford the social interaction found in the street. Compared to the sociopetal public space in the slums, where people pass each other's houses, talk to each other, and see things happen, multi-storied buildings are sociofugal (Photo 197). The double loaded corridor, typical of rehabilitation blocks, consisting of condominiums on both sides of long straight corridors, is not an intentionally made space. It is a necessity created to connect homes in a market-wise efficiency, not for social effectiveness.

The single-purpose-circulation space in mass housing is void of social. The same applies to freeways, car parks, and playgrounds. Christopher Alexander (2002c) argues that one of the properties of live buildings is their being composed of positive spaces. With this, he means that, much like in a cluster of soap bubbles, there is no random leftover space. One can imagine the same pattern for the social. This interstice space is the physical division and it inevitably creates a discontinuity in the social. Interstice space is rare in vernacular environments.

Photo 197. Corridors in multi-storied tenement blocks serve exclusively as circulation space and do not afford the social interaction found in an ordinary street. Dharavi, December 28, 2012.

About the effect of high-rise, Bhau Korde points out that the connection between people is decreasing. "Children are now coming home from school, have their own room, and get disconnected from their parents. The homes here on the floor suffer from the same problem. They lack a communal space where people can sit together. In multi-storied building, people only meet in the elevator, which is too small a space and too short a time for proper socializing. In fact, people enter their homes without contact with their neighbors. In the slum, people are more connected. They will pass each other's homes and say hello or have a chat. The logic of the slum is that economic activity and household care are combined." In multi-storied buildings, this connection is lost. The division of living breaks social connections. Economic systems even replace family connections. Architecture of multi-storied buildings is based on the nuclear family. It does not afford the lifestyle of the joint family. "Most thinking about development is about 'money and facilities'; economic thinking is destroying human development. We are moving away from the human touch. This architecture is detaching human relations. In order to improve things, I kept the door of my flat open and asked neighbors to do the same. Now doors in de building are open on all floors.

We made foldable doors so that we can subtly regulate connection. It also contributed to cross ventilation in the building." (Bhau Korde in interview November 10, 2012 SdM).

Transition Support

As seen in the strategies of the alliance, much effort goes in the long run towards the creation of permanent housing. Having the walls built that eventually make the new home is only a small part of the whole process. The Slum Redevelopment Society (also SRS, not to be confused with Slum Rehabilitation Scheme mentioned earlier), which worked on creating permanent housing for slum dwellers even before the SRA was established by the Maharashtra government, provides a so called 'post-rehabilitation program' that addresses the changes that come with the transition. It also supports people who have become victim of failed projects. The program aims at forming housing societies, and training dwellers to maintain their homes. Like the alliance, SRS sees capacity building, income generation, education, and empowerment of women as key activities.

The fundamental difference between developers' projects and those by SPARC, MM, NSDF, SRS, lies in their focus. Developers aim at producing built structures, whereas these NGOs work on helping people acquire better housing. It follows the commodity – vernacular distinction. Developers produce for the market, while the NGOs see the head of the household as the source of growth.

Density and High-rise

The problem of high density begins with the problem of too little land per capita. The standard response to this land shortage is the creation of stacked floor space, i.e. multi-storied building. This is why Dalvi calls redevelopment projects the 'latest form of land reclamation.' From skyscraper design, it is known that the space needed for elevators and staircases limits the effectiveness of high-rise. In lower, let us say 25 storied, residential building other factors limit the effectiveness even further. Mumbai based architect Charles Correa argued in (Correa, 2008) that adding floor area per capita is of limited help as necessary amenities require land outside the building as well. In fact, the effectiveness of saving land by adding more floors (i.e. increasing the FSI) decreases rapidly between five to ten floors. As is visible in Diagram 9, stacking luxury housing may be effective until 20 floors, but for 'Economic Weaker Section' (EWS) dwelling, it turns out that building higher than five floors is not effective.
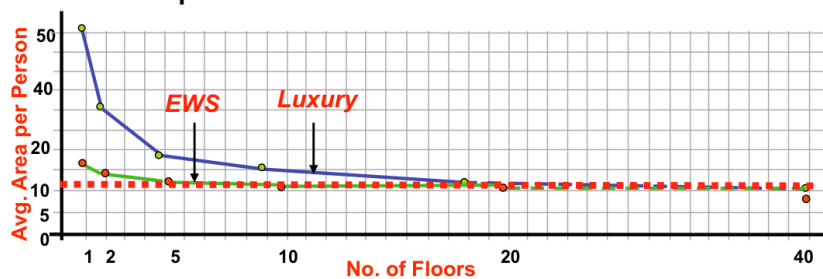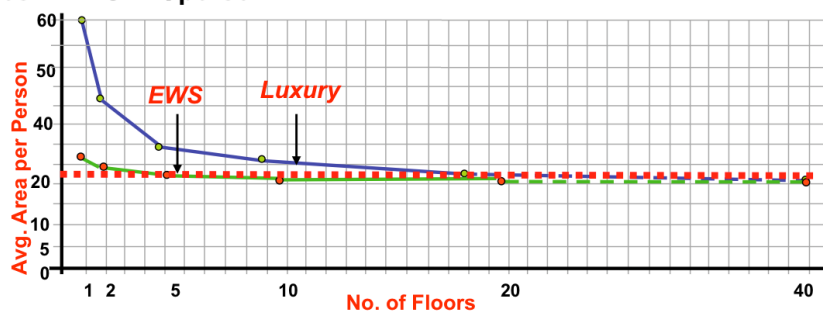
Diagram 9. Effectiveness of high-rise depends on necessary ground-bound amenities. The curves show the amount of land needed per person in relation to the number of floors. The dotted red line indicates where both curves flatten out. 10 m² of amenities per person is the bare minimum, whereas 20 m² is more realistic. Diagram by Charles Correa (Correa, 2008).

In a 1971 study for the City and Industrial Development Corporation of Maharashtra (CIDCO) by Mumbai based architect Kamu Iyer, a friend of Charles Correa, compared buildings of between 2 and 12 stories and came to similar conclusions. Since high-rise requires heavier structures in the lower part of the building, cost increase follows a non-linear curve. In addition, high-rise blocks require greater distance between them in order to avoid the side effects of the SRS-scheme as shown in Photo 193. Consequently, there is no land gain in building higher (Iyer, 2014). The popular belief that high-rise is the cure for high population densities, is a myth. Correa concluded

that "To grant a higher FSI in order to house the poor is a fallacy." As long as there are too many people in an area, there simply are too many people in that area, no matter what way they are packed or stacked. Correa's, Dalvi's, and Iyer's arguments lead to the conclusion that high-rise is less effective for housing the poor than it is for housing the rich. Given that slums are in general not inhabited by the rich, high-rise of more than five stories does not contribute to tackling land shortage.

Vertical Slum

Photo 199. In Kolya Khata building at the heart of Dharavi, squatters have appropriated the first and second floor, whereas all other floors are vacant since 2005. Kuttiwadi, April 19, 2013.

It happens that housing projects fail already during construction. An example is the 256 tenements Kolya Khata building in Kuttiwadi, Dharavi. The story goes it was developed in 2005 for the relocation of slum dwellers who then occupied land along railway tracks. The contractor failed to finish the project within the budget and now the building is subject of lawsuits. All that was built was a GF+7 concrete structure. Gradually, squatters appropriated the structure and added doors and window grills. Nowadays, the first and second floors are inhabited. Higher floors are not, since pressure in the water piping is too low to reach that high, and carrying water all the way up is not an option. Residents have actually blocked the staircases that go further up. Ground floor is also not inhabited, as it is too dangerous. Today it is the domain of glue sniffers and drug addicts. The people in the slum surrounding Kolya Khata would rather see the whole building disappear. They complain about the bad effect criminals have on their youth. Rumor has it people even move out of first and second floor nowadays.

Photo 200. Kolya Khata's ground floor has become a hangout for glue sniffers and drug addicts. Kuttiwadi, July 25, 2014.

The vacant floors in Kolya Khata put forward several issues. Bearing in mind that Kolya Khata sits at the heart of Dharavi, surrounded by slums where the demand for housing is enormous; one would expect the building to be appropriated in no time, whereas it clearly is not. Of course, regular water piping does not reach high enough, but the use of DIY piping and an electric pump is common in all India. The vacancies on ground floor are just as enigmatic. Most settled Dharavians live on ground floor and rent out the upper floors of their dwellings. The idea that living on ground floor is unsafe is apparently not that relevant. This suggests that a layout with a central double loaded corridor that is for circulation only and with tenements that have their back towards public space is deeply contrary to what people prefer.

The 75% vacancy in a context of severe housing shortage suggests that living conditions in Kolya Khata building are worse than in regular ground bound slums. The structure, i.e. the design of the building, is apparently not even suitable for squatting. This case suggests a profound mismatch between high-rise and what people need. Demonstrably, people prefer to pay a considerable rent for a slum dwelling to squatting in a free of cost third floor half-finished tenement.

This also sheds light on the phenomenon of people leaving other high-rise redevelopment projects and returning to the slums. It supports the observation by SPARC's Keya Kunte that people leave market-supplied mass housing because of its inadequate design[50].

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[50] Interview with SdM on April 17, 2014.

From Vernacular to Commodity (Discussion)

In this chapter, we have seen that the influx of informal settlement in Mumbai is essentially the manifestation of a housing crisis negotiated by the migrants' vernacular. In the city that is not capable of absorbing its new residents, both sides struggle to soften the collision and eventually come with various strategies. Slum dwellers who manage to acquire security of tenure, engage in a natural process of owner-builder driven housing improvement. Their interactions with the formalized city mainly aim at official recognition of their presence. Others, who participate in official improvement schemes, can get support from NGOs. Their aim is to learn how to deal with the formalities of the city, and use those skills for the development of government sanctioned permanent housing. Like the owner-builders, the residents are in charge of this process, which can therefore be categorized as vernacular.

In the third option, slum dwellers trade their rights for a tenement built by commercial developers. Their new housing is a commodity paid for with rights and money. A fourth option is the case where poor slum dwellers get a minimum-size tenement free of costs, in exchange for the land they occupied. In the scheme that affords this creation of free housing, the tenements are only inevitable by-products. Their role is that of catalyst in the production of profitable housing. In these schemes, there is no role for the residents other than delivering the land. After that, there is no incentive for both developers and residents to make the housing work. Since residents are not in charge in this process, their only option is to adapt to the building as it is. Since such a situation deprives people of their autonomy, their last option is to leave and go back to the slum.

In the first two options, dwellers are in charge of the situation and of the changes in lifestyle that come with living in the city. Less in charge are those who move to high-rise, the third option. For them, the changes are more drastic. Emblematic of the social disruption are the disappearance of the veranda and the introduction of the sociofugal double loaded corridor. The fourth option is potentially the most problematic since inhabitants have no handle on the owner of the building. The owner in turn, has no stake in accommodating the inhabitants.

Housing Occupancy

As mentioned in Wedding (page 235), the format of the family has changed with modernization. A brief investigation of census data about housing occupancy in The Netherlands was carried out in order to verify this observation. Data was retrieved from Dutch censuses (Boonstra, Doorn, Horik, Maarseveen, & Oudhof, 2007; "CBS StatLine," n.d.). Diagram 10 displays the data covering two centuries of industrialization and modernization in The Netherlands. As seen in India, the format of the average family occupying one house is changing from the extended family via the joint family to today's nuclear family. Consequently, the number of people per household must have decreased, as the data indeed confirms; housing occupancy has dropped by two third. Diagram 10 also suggests that this change in household composition set in with Modernism and mass housing production in the 1920s. Before, the number of persons per household was constant. Moreover, the data shows that until the 1950s, houses were occupied by more than one household. House and household reached parity in the second half of the 20th century.
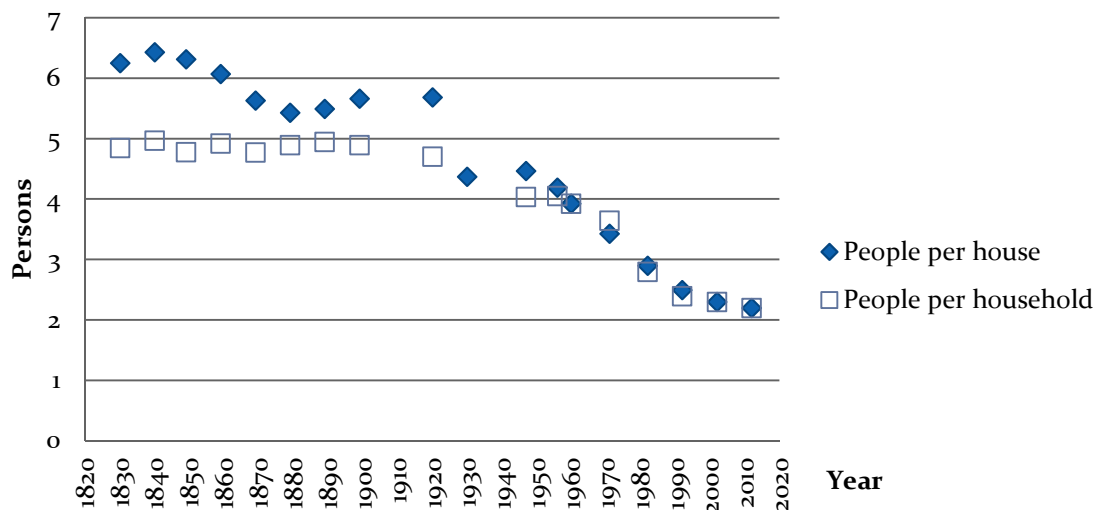
Diagram 10. Housing occupancy in The Netherlands has dropped by two third, i.e. the individual person occupies a three times bigger portion of the house than two centuries ago.

In the diagram, the 1930 and 1970 data seem off the trend. This is partly caused by changes in sampling methods and categorization criteria. The definitions of the data presented in the census reports therefore differ from one edition to another. People living single for example, were long time not considered a household. Where possible, such differences were corrected with interpolations. The evolution of census techniques however leaves the observed trends unchanged. Besides the above findings, the categories used in the censuses from 1795 to 2014 revealed certain trends in the social dimension of symbiosis, i.e. about how society makes use of the symbiosis. Overall, censuses diversified and increased their sampling, as shown in Table 6.

Census year	Sampling categories in addition to the previous census
1795	People per province.
1830	People by gender, type of housing, households, and religion.
1849	Marital status, permanent/transient, and origin (migration).
1859	Classification by administrative, legal, electoral, military, and school districts.
1899	Distinction between family and institution population. Details about rooms per house, boat, or wagon. Number of people per room.
1930	Further distinction by types of institutions. Occupied and unoccupied houses, hotels, schools, churches, offices, factories et cetera.
1947	Detailed information about properties of the built structure, function, value, property, household composition.
1960	Central Bureau for Statistics (CBS) takes over the role of censuses.

Table 6. Diversification of sampling in successive Dutch censuses.

The trend found here is that of a shift of focus. Identification of a person evolved from house, household, and religion (1830) via location (1849), governmental categories (1859), functionalism (1930), to physical and economic properties of the building. The trend in censuses therefore is that people were initially categorized by their social context, then by formal categories, and later by technium and commodification.

Results of the Case Studies on High-Tech Buildings

Introduction

The previous chapters covered the results of the case studies on vernacular and transitional. For the overall research question of this thesis, "How did the symbiosis of people and buildings develop in the transition from vernacular to modern?" it is essential to also investigate the other extreme: symbiosis of people and high-tech buildings. So far, the case studies focused on vernacular environments and what impact modernization has on them. The chapters about slum and redevelopment are an investigation of the collision between vernacular and the modern city. This collision is in a way a violent variety of the transition. In order to identify what precisely vernacular is colliding with, further investigation is needed of modernity. For this, three cases studies were conducted on high-tech buildings in Switzerland. Compared to the hamlets in Bihar and the slums of Mumbai, these high-tech buildings seem a different world. The research strategy of this thesis however, is to observe symbiosis against different backgrounds. By making the range span from vernacular via transitional to high-tech environments, the mid part indeed becomes transitional. Without the high-tech part, the range would be too short to unravel the untouchable building syndrome.

A-One Business Center

Research Design

The aim of the case study was to assess the symbiosis of people and building in a situation marked by high-end technology and formality. The subject was a recently completed business center in Switzerland, hosting companies of various origins. The technology used in the building is state-of-the-art and Switzerland is a highly formalized country. Data was collected by means of:

– Mapping the built structure and building services;
– Identifying the real estate business model;
– Surveying operability of building elements and autonomy of occupants;
– Interviewing occupants.

Interviewees

The companies residing in the business center are mainly multinationals. They are typically branch offices and European headquarters, with up to 300 employees. The international character comes with various cultural backgrounds. Hence, the organization of the workplace and workspace differs per company (Zimring & Peatross, 1997), as does individual behavior regarding the building.

As building needs in business change from day to day, some of the companies were housed in cabins on the construction site, months and even years before the building was completed. Many of the people, who now work in the building, have a shared history in an office elsewhere or in the cabins on site.

The research focused on facility managers since the field of their jobs is closest to the topic of this thesis. Their job is to facilitate a building to workers as an optimal working environment. It requires detailed knowledge of what the building affords and of what people want. The facility manager collects and deals with feedback and complaints. One of the occupants is an entrepreneur who rents out small office workspace to third parties in a shared office concept. Since the business center consists of several buildings, one facility manager (referred to as the 'caretaker' in the following) takes care of the whole complex on behalf of the owner, independent of the tenants.

Description of the Building

Photo 201. The business center has full glass facades with extra glass screens to the motorway, typical of contemporary architecture. July 2012.

The business center is a composition of eleven glass boxes, of which five are partly built over open space (Photo 201). Floors and structural cores are made of concrete, the facades of glass in metal frames. All windows are equipped with louvers. The facades are an active part of the center's climate system and therefore the louvers are semi-automated. The center complies with Switzerland's *Minergie* standards regarding energy consumption. All floors are equipped with raised flooring containing most utilities and building services (Photo 202). Ventilation is supplied through grills in the floor; air exhaust goes through ceiling rosettes. Air is not humidified or dried.

Heating and cooling are distributed to the concrete ceilings of which the temperature is controlled per section. Each ceiling is subdivided in nine sections (Diagram 11) as to afford adaptation to the exterior conditions (wind, sun) of each façade. As two facades in different directions influence the corner spaces, these spaces are controlled separately from the mid sections. Temperature is normally kept at 21°C and tenants can adjust between 19.5°C and 22.5°C. The response of the system is quite slow and it takes several hours before adjustment becomes noticeable.

North

West   East

South
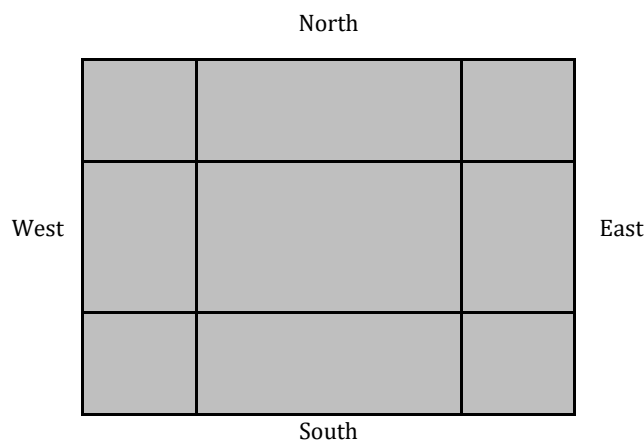
Diagram 11. Temperature management divided in nine sections, affording compensation for differences in exposure to the exterior and orientation to the sun.

Real Estate Business Model

The business model of the A-One Business Center is that of renting out office space to companies. Typically, rent agreements speak of an 'owner package' and a 'tenant package' containing respectively what comes with the rent and what the tenant has to bring. In general, the owner package includes the main structure, facades, building services, and raised floors. The tenants take care of flooring, soft furnishings, decoration, occasional false ceilings, partitions, grills and fittings, lighting systems, cabling, and all non-fixed items. In order to keep uniformity in appearance and quality, owners can put restrictions on the choice of brands and suppliers of tenant package items.

Photo 202. Typical office interior with a raised floor containing ventilation and cabling. July 2012.

The business center consists of eleven buildings, varying in size. Some companies rent a whole building, others only a floor or part of it.

Findings

The building is designed for use as open plan office. A compartmentalized office, as preferred by several tenants, fits less well with the section wise temperature management, since rooms with different occupancy respond differently to heat and cold supply. Large rooms have more people and heat producing equipment per square meter than smaller rooms. The caretaker explained that the typical tenant in the business center is an international company's European headquarters, which comes with a large proportion of confidentiality intensive jobs not suitable for an open plan office. Complaints about heat and cold in the building are inherent to this mismatch of a cellular office with the open plan energy concept. This explanation is consistent with what the facility managers of the various tenants reported.

The Minergie concept has led to a design in which one can adjust the temperature only slowly; sometimes it takes several days. In addition, the building's energy balance is based on an assumed full occupancy of for example 300 workers, whereas currently 150 are yet employed. The interviewee considers this unbalance of assumption and reality a fundamental problem in managing temperature and humidity.

Operability of Building Elements and Autonomy of Occupants

An interviewee qualified central control of the louvers and blinds as "the most annoying item in this *Minergie*-labeled building". The frequent opening, closing,

raising, and lowering is the main source of complaints. In strong winds, the window blinds are raised in order to avoid damage, even in bright sunlight, which then leads to an excessive heat load that the building's services cannot handle. An interviewee mentioned an organization in a neighboring building installing additional blinds on the inside of the façade, operable by the individual workers. Another facility manager mentioned workers complaining about the central control of the louvers and reporting feelings of imprisonment, similar to the effect of lack of operable windows.

Ventilation is generated centrally but distributed through ducts and grills that are part of the tenant package. The occurrence of complaints appeared to be linked to the tenant's operation of this technique. Regarding the floor system affording relocation of the grills in relation to furniture layout, one facility manager reported that this adjustability is used frequently. As a result, there seem to be no complaints concerning draft. Another facility manager described the situation in her company where some workers experience draft and close the grills with tape. As a result, air flows out through other grills at a higher speed, leading to new complaints about draft. Fine-tuning of the system (by relocating the grills) is blocked by the company's austerity measures.

Transition from Cabins to Building, from Basic to Luxury.

One of the organizations is using the building since 2008, after spending three years in cabins on the site. Interviewee reported no specific changes in building related behavior or attitude of workers in the transition. Workers equally take care of their environment. The building is experienced as more comfortable than the cabins. Interviewee reported that an organizational issue during the cabin days contributed to the tolerance for inconveniences. The multinational company established this branch office in order to launch its luxury brand in Europe. In the pioneering phase, a shared ambition was felt regarding the project, which compensated for the lack of comfort.

Taking Care of One's Workspace

In a denser office setting, as in the cabin office, workers took more care and contributed more to keeping things tidy. One of the facility managers observed more social interaction in that setting. "In the new building, people get egoistic." About the open plan concept she remarked that workers "take care of their workspace, but care less about their environment" and "open plan creates indifference and negligence". In comparing the current office building with previous cabins and other buildings, interviewee said the A-One building does not fit with the company's social culture, that a lack of interaction with the building leads to individualism and makes people act less responsibly.

The tenant subletting office space to third parties observed that independent entrepreneurs take better care of their space than workers of larger organizations. Especially workers of international companies tend not to keep things tidy.

One interviewee observes a decrease in sense of responsibility due to the high degree of automation. "It is as with children, by letting kids do things themselves, they learn to be responsible. When you don't educate them, they don't care about things." "*Le plus responsable, le plus sain*" (The more responsible, the healthier). "*Automatisé est rasant*" (automated is boring). "*L'automatisme, je suis contre*" (I'm against automation).

Formality, Design, Aesthetics

Regarding window blinds, an interviewee reported some counter-intuitive situations: blinds on north façade, blinds on a façade where the overhang of the first floor is so big it allows no sunlight to enter all year round (Photo 201), and blinds installed on the outside whereas on the inside they would be less vulnerable.

The entangled character of regulations, building codes, and the technique stands out in one of the responses: "The best quality of the building is safety; it is very well protected against fire. The least quality is temperature management. Additional electric heaters are tolerated, even though this causes fines for excessive energy consumption."

Minergie

About the *Minergie* concept, an interviewee argued, "*Minergie* should be people friendly, but is only environment friendly." This unfriendliness to people comes from the lack of sense of being in control. *Minergie* is perceived as an excuse not to adjust the conditions to the people. Interviewee considers the design that made meeting the *Minergie* standards possible, "much too rigid" and "not meeting the need for adjustability".

Another interviewee called the *Minergie* concept a bad idea, as she considered it not fit for the climate of the *La Côte*-region (between Jura Mountains and Lake Geneva). "Windows are not operable; blinds are always down and hinder the view on the lake. They create a sense of imprisonment. Most time of the year the building is too cold." Regarding the opening of windows, interviewee mentioned the need to be in touch with the outside world. "The view on the lake cannot be experienced fully when all windows are closed, it just makes no sense. It is bad for people's morale." What the interviewee refers to is how the technological approach is interfering with human perception as a full-body experience.

Discussion

As mentioned, complaints about heat and cold in the building are inherent to the mismatch of cellular office layouts with the open plan energy concept. In the symbiosis model, this means that the social dimension, i.e. the organization's structure, does not fit with the formal dimension i.e. the technium, the *Minergie* requirements, and the business model.

The slow response of the climate system does not fit with variation in room occupancy. In other words, common behavior of office workers is not calculated in the design of the building services. People thus are subordinate to the technium. Adequate solutions like operable windows are not an option since they would introduce uncertainties in the calculated energy consumption. Moreover, when energy consumption is not according the pattern mentioned in the rent agreement, the tenant is fined i.e. regulations favor the technium over people.

The findings regarding the ventilation grills show that organizational issues have an impact on the symbiosis: although the system is part of the tenant package, office workers are dependent of others in the organization (i.e. hierarchy) to improve their situation effectively. Although there is harmony between the building and people in some companies, the social and the formal block it in others.

The ambition to reduce energy consumption has led to the application of semi-operable louvers, screens, blinds, and non-operable windows. These provisions hinder people's perception of the environment and create feelings of imprisonment. In this design, comfort is primarily defined by physical parameters. The design favors the technium over human perception, whereas it would be possible to use perceptual phenomena to save energy. As explained in the Adaptive Comfort Hypothesis (page 46), reduction of heating and cooling is possible when office workers have more control over windows and building services. The design of the A-One business center however puts all cards on the technium and keeps people out of the equation. The energy saving strategy used here is based on exclusion of people. Besides the opportunities afforded by more control to the occupants, inclusion in other fields also contributes to comfort. The shared ambition helped workers to cope with poor working conditions in the cabins. The sense of inclusion that comes with *shared* and challenge that comes with *ambition*, contribute indeed to tolerance.

Or, as one interviewee put it:

> Q: "What do you consider the best quality of this building?"

> A: "Security, it is a very secure building. But it is a *Minergie*-building and its main problem is that it is not possible to open a window."

The EPFL Rolex Learning Center as a Learning Project

The Rolex Learning Center (RLC) of the Swiss National Institute of Technology EPFL is the high-profile architecture flagship of the EPFL campus. It hosts libraries of all faculties, a conference theatre (The Rolex Forum), workspace for students, catering, offices for staff, and basement parking. End-users can be categorized as one-time visitors (tourists), visitors (professionals), frequent occupants (students, faculty), and permanent occupants (staff). The exceptional architecture of the RLC comes with challenges for all participants in the project, and makes it a rich research subject, as many of the applied solutions likely do not come 'from the shelf.'

Introduction

Proper assessment of the quality of a building requires assessment of the whole project. People using the building in its operational phase will experience the consequences of decisions taken by others who, for example, have used it as a business opportunity during construction.

The word *Building* can refer to both a built structure and the activity of creating that structure. Apart from this linguistic connection, a building is the result of a building process and therefore reflects all aspects of that process. A distinction is made here between *the building* and *the project* in order to distinguish the physical structure from the process of Definition, Design, Construction, Finance, Maintenance, Operation, and Use.

The difficulty of assessing the quality of a project lies in the complexity that comes with the variety of stakeholders. By definition, they have different interests, act on different moments, and do not necessarily have a shared ambition. The focus of this study will be on the project as experienced by the end-users, among who were reckoned office workers, library visitors, students, as well as catering, cleaning, and maintenance personnel. After all, they have the most involvement with the building. Meanwhile, end-users rarely participate in the concretization of the project's ambition while the purpose of this research is to understand how end-users connect with their building.

Besides the focus on the end-user, the question is also to what extent the architectural design, its tectonics, and its aesthetic concept are in sync with what is construction-wise feasible. The exceptional design turned out highly demanding for all builders involved.

Research Design

The case study research on the Rolex Learning Center was conducted in the framework of the 'Building as Social Platform' doctoral week 2012 at EPFL taught and supervised

by prof. Paolo Tombesi, of the University of Melbourne, NSW Australia. Other researchers were Alexandra Thorer and Steven Gheyselinck, both PhD-candidates at EPFL. The aim of the study was to identify factors in people-building relationship by analysis of the various stakeholders' perspectives.

In addition to this collaborative research, interviews were conducted with various people like students, librarians, and EPFL-staff involved in the RLC project. Interviews were held in the form of guided conversations, as described in (Kaufmann, 2011).

Mapping the Aspects of 'Project as a Process'
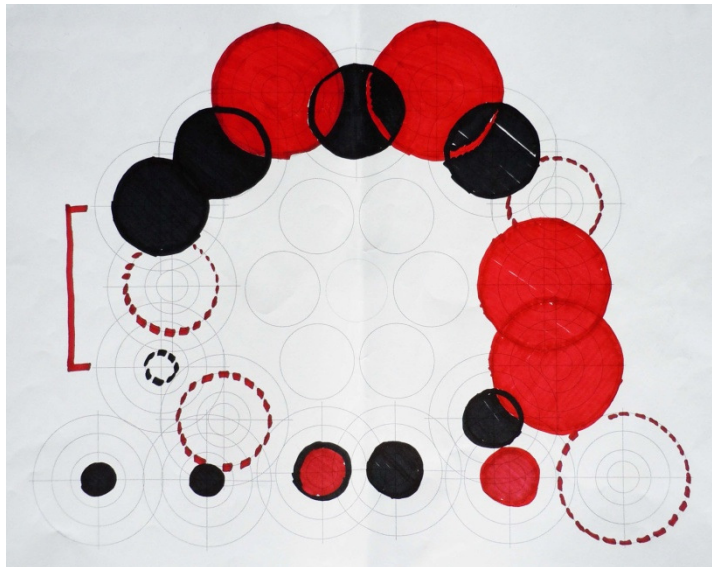
Diagram 12. Summarizing graphic of the design hierarchy. Each circle is a design aspect, the size of which represents importance. Aspects in red are considered critical. Image by Paolo Tombesi.

Based on personal experience with the RLC and a first general survey of the building, all researchers made an individual assessment of the hierarchy of project aspects. This was done by grading the importance of each aspect on a scale of *topical - conditioning - considered - default* and by indicating if the aspect is of *critical* (red) importance or not (black). The 19 aspects assessed are Program, Space Visuals, Performance, Specification, Material Systems, Tectonics, Fabrication, Testing, Assembly, Site, Use, Maintenance, Change, Coalition, Operations, Procurement, Resources, Stakeholders, and Goals. A diagram of 19 circles representing importance (diameter) and criticality (color) displays the resulting assessment. In the research group, common understanding of the design hierarchy was reached through evaluation of every individual assessment diagram, until consensus was reached on one summarizing diagram. Diagram 12 shows a strong design hierarchy. Certain aspects are present whereas others are neglected. The image is that of a building perceived as performing well while having multiple issues. Ideally, a building should perform high on all aspects. The diagram also suggests that in the RLC, the various aspects are not correlated, as will be discussed below.

Photography / Fact Finding

In a second survey, each researcher focused on a limited set of design aspects and collected data of how each aspect is reflected in the RLC's architecture. Photography served as data collection tool here, with the instruction that every photo should be self-explanatory. As part of the sampling strategy, the second instruction was to present the facts in a neutral way, as especially photos showing things in a negative way tend to raise debate and are apparently insufficiently self-explanatory. Reviewing the photos in the research group filtered out ambiguous data. Adobe Photoshop Elements 9 Organizer served as data management software. Tagging (labeling) photos was used to test the quality of the data and to come to further data reduction.

Mapping 'Building Use and Maintenance'

In addition to the above aspect driven assessment, the building and its site were used as a comprehensive sample in an elaborate analysis of 'building use and maintenance.' By mapping Flows, Crowding, Maintenance, Cleaning, Temperature, Ventilation, Light, Acoustics, Privacy, Safety, Security, and Provisions for people with disabilities, data was collected that could reveal patterns and connections between the various aspects and phenomena. Mapping was done on floor plans. The collected data was checked in interviews with regular users of the building.

Results

Description of the Building
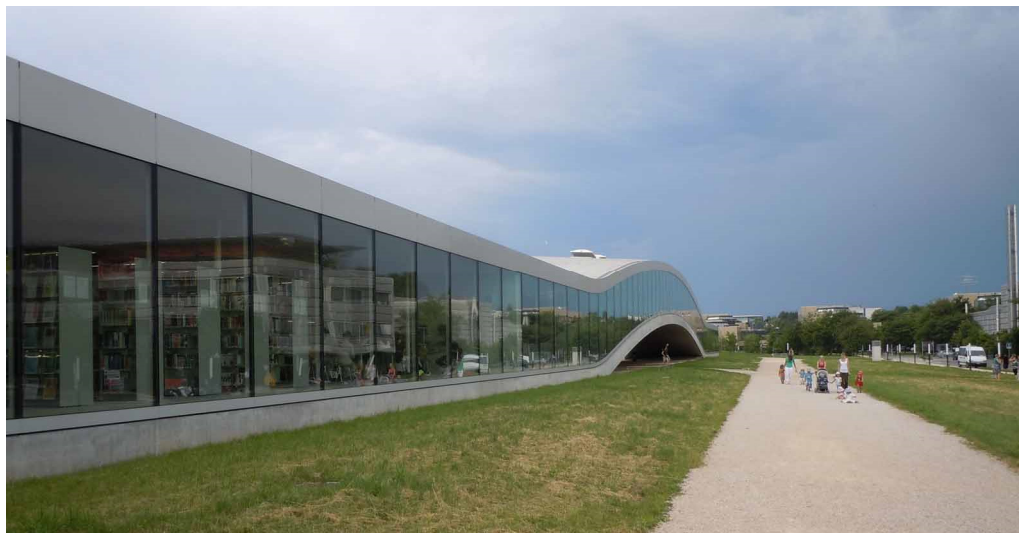
Photo 203. EPFL's Rolex Learning Center is an undulating one-story building. June 2012.

The RLC appears as a one-storey building that lifts itself from the ground like a rippled carpet. The undulations represent the Swiss mountainous landscape. As the building has one single height, the outdoor space continues under the building wherever it does not touch the ground (Photo 204). The site itself is flat and has a basement parking,

which serves as a foundation for the RLC. The structure is a one-pour concrete slab, referred to as 'the shell', of which the arches are kept up by means of post-tension reinforcement bars that lie hidden in de basement's roof.

Round patios of various sizes pierce the single storey main volume. All facades are made of floor-to-ceiling glass panels. The roof is a light wooden structure covered with panels and sheets.

Photo 204. The RLC's undulations detach from the ground. July 2012.

Flows

The RLC's interior design resembles an open landscape with no predefined routes. Most visitors however come with a certain goal (visit the library, have lunch, have a meeting) and their routes radiate from the building's entrance to the distinguished functions. Therefore, most route patterns look like branches in a tree. Free flow movement is mainly found inside the library section, which covers less than half of the building.

Routes that look more like a network are those designed for people with disabilities. Texture striping in the floor finishing is applied only on level routes in the landscape, i.e. on ridges and in valleys. Lower and upper routes are connected by zigzagging ramps and mechanized plateau lifts that serve for transportation of goods (books, supplies). This network of assisting paths does not connect to designated work areas.

To avoid theft of books, RFID readers, barriers such as plant boxes, and blocked spaces, surround the library. Although visually open, these areas do not allow an actual free flow of people and a network shape routing pattern does therefore not occur.

All rooms have a non-rectangular floor plan (elliptical or round). Many of the thoroughfares between rooms are too narrow for passage. Although visually open, they are effectively cul-de-sacs. The same goes for narrow areas of which the end cannot be

seen from where one stands. This effect occurs in areas adjacent to each of the three mechanized plateau lifts. Either the curvature of the floor or that of the façade is blocking vision. Other cul-de-sacs occur in the folds of the zigzagging ramps or are due to blockages related to the library's security issue.

On site and under the shell, most flows go in straight lines to and from adjacent functions and follow the most efficient routes around buildings and other objects. These do not necessarily follow the designed paths, as is shown by several 'elephant trails' that run in straight lines from one object's corner to the next. Apparently, lack of adequate pavement does not withhold people from choosing the more efficient direct route, except in bad weather when the informal paths are muddy.

Crowding

Photo 205. Library visitors seek quiet individual workspace whereas the furniture arrangement affords conversation. Signage tells visitors to refrain from talking. June 2012.

Crowding is a social condition in which privacy mechanisms have not functioned effectively, resulting in an excess of undesired social contact (Altman, 1975). In order to map crowding and privacy, proximity and distances in terms of intimate, personal, social, and public space were used as described in (Hall, 1990).

Students use the RLC intensively during exam periods. Most working areas for students are equipped with sets of round tables and chairs that invite to socializing. Signs on the tables however suggest talking is not allowed, and neither is socializing. The design is that of a sociopetal area, resembling a cafeteria's terrace, whereas its purpose is to provide quiet, sociofugal, personal working space (Photo 205). In quiet times, when not all chairs are taken, one can work here without interfering in other's personal space. In exam periods, when the area is used at its maximum capacity, people's personal spaces

inevitably overlap. The choice of furniture also contributes to the sense of crowding since personal spacing mechanisms make a table intended for six persons appear 'occupied' when only one or two persons sit there (Sommer, 1969).

Once all regular work areas are in use, additional tables are brought in. As such, extra work places require a level floor; the extension of work area is limited. The adding of tables would cram the area, as spreading the furniture over a larger area is not possible due to the slopes in the landscape floor. Crowding is therefore inherent to the landscape concept. Once these added tables are occupied too, the next students use the ubiquitous beanbags on the slopes, mainly where the building provides backing. Therefore, most beanbags are found along the patio windows and the movable partition of the Rolex Forum (south-west corner of the RLC). Improvised workspace is also found on wheelchair ramps, where students use raised parts of the ramp as worktop (Photo 206).

Photo 206. Since sloped floors do not afford the use of furniture, students use wheelchair ramps as worktop. June 2012.

The building also attracts students from other institutions than EPFL, like the University of Lausanne and even from other cities. Crowding has led to requests by EPFL students to ban other students but as there is sufficient room available in surrounding buildings, EPFL will not ban external students. The attractiveness of the building is apparently greater than the negative effects of crowding, and people willingly engage with it.

Privacy

Some of the office rooms have floor to ceiling glass partitions to adjacent public parts of the building (Photo 207). In rooms where workers have a personal desk, cabinets and plants are used to mitigate the openness and create privacy. As opposed to these cases of apparent over-exposure, in other rooms the absence of windows creates a sense of confinement.

Photo 207. Over-exposure of a worker in an individual office next to a crowded public workspace. June 2012.
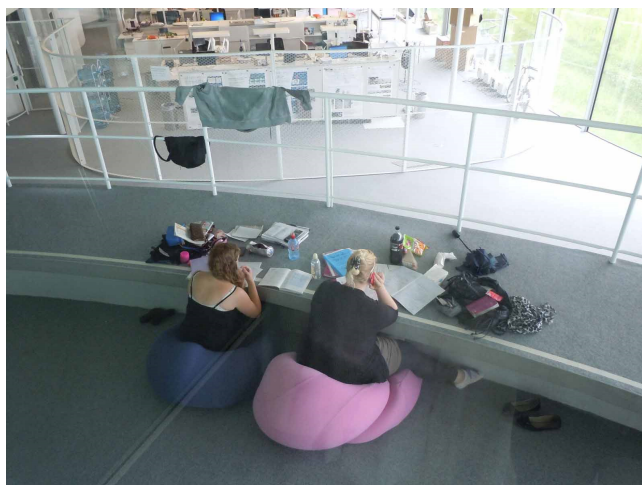

Photo 208. Workers in the office (top of photo) feel visually and acoustically exposed to visitors and students using the upper part of the public area. June 2012.
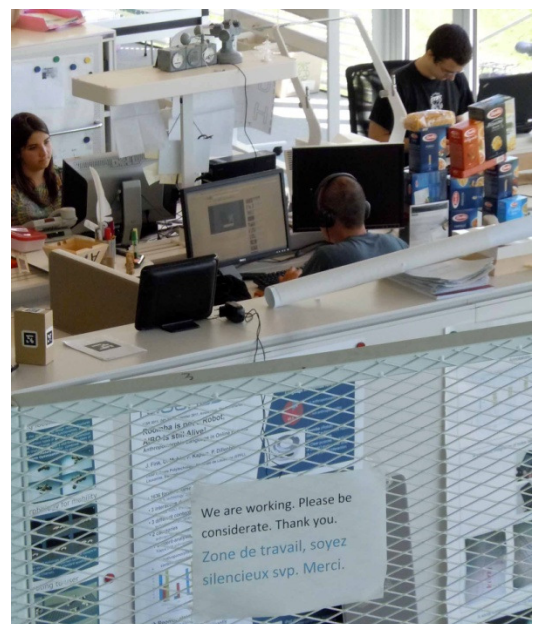
Photo 209. Office workers ask for privacy. June 2012.

Workers in one specific office area along the east façade reported a lack of privacy due to exposure to a steep slope in the landscape floor (Photo 208 and Photo 209). Five glass bubbles containing ten conversation rooms sit on the top of that slope (Photo 206). The slope serves as an overflow area (see *crowding*) and the combination of slope and rooms acts like a theatre in which the low-lying office is the stage. Workers feel watched permanently, which is an indicator of public space intruding the personal space.

Cleaning

Cleaning requires that all surfaces of all objects afford being cleaned i.e. that they afford adequate access and do not wear under regular cleaning. In our survey therefore, *accessibility* and *sensitive technology* were identified as groups of potential issues.

Accessibility

All rooms have a non-rectangular floor plan (elliptical or round). Many of the thoroughfares between such rooms are too narrow for passage, let alone for cleaning. Wall finishing show stains and stripes left behind after attempts to enter the narrow space with vacuum cleaners and other equipment. The folds of the zigzagging wheelchair ramps bear similar traces (Photo 210 and Photo 211).
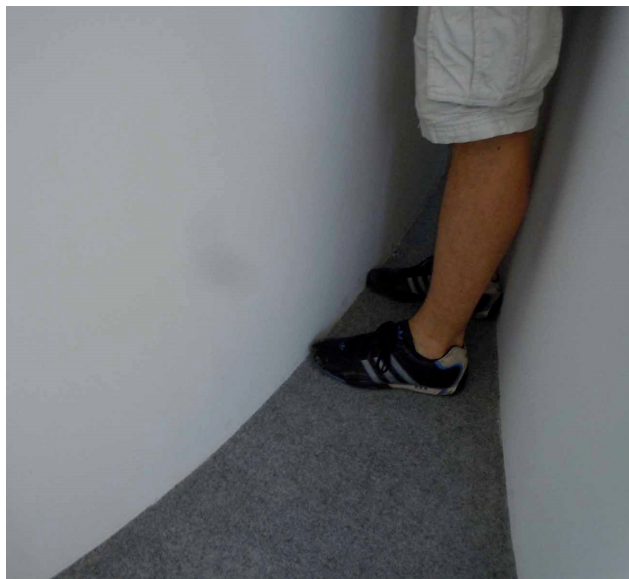
Photo 210. Space between bubble-shaped rooms is too narrow for passage and consequently for cleaning and maintenance. July 2012.

Photo 211. The folds in the wheel chair ramps do not afford the use of ordinary equipment like vacuum cleaners. June 2012.

The restaurant plateau, the circular Ancient Book Collection, and one of the wheelchair ramps consist of overhanging concrete slabs. Due to the underlying undulating landscape floor, the height under these slabs varies from low to zero, which makes them inaccessible.

All operable windows are equipped with steel wire mesh in a non-operable steel frame to prevent people falling out. The inside of the window, the window frame, and part of the floor are inaccessible for cleaning because these meshed frames are on the inside of the façade.

The walls of the bubble shape rooms do not reach up to the building's ceiling. Some of these rooms however, have their own flat roof, in short distance under the main ceiling. These interior roofs are barely accessible for cleaning.
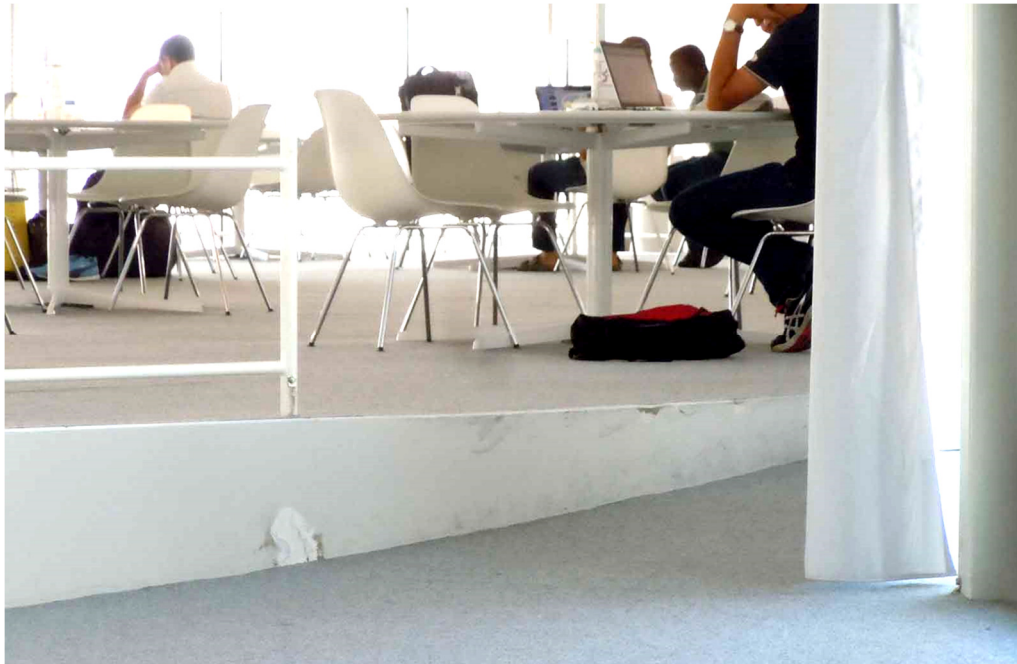
Photo 212. The absence of plinths and trims affords quick wear. July 2012.

Sensitive Technology

The most conspicuous piece of sensitive technology is probably the light grey synthetic felt carpet, specially designed for the project. Normal use however does not consider aesthetic ambitions and critics have observed that already two years after opening, the interior makes a worn and aged impression (Dufour, 2012).None of the vertical surfaces (dry walls, wet walls, facades, fixed furniture) has plinths. Consequently, trolleys, shoes, and floor cleaning equipment leave stripes, stains, and damages. The issues mentioned here all result from the strong architectural concept that is inconsiderate to common maintenance practice.

Maintenance

Accessibility for maintenance has the same issues as mentioned under *Cleaning*.

Sensitive Technology

To make the carpet follow the undulations of the landscape is only possible with specific cuts and triangular shapes. The pointy corners of these pieces tend to

disconnect from the screed. It is an example of the chosen form not being compatible with the material. Builders cannot achieve a proper result with such a combination in the design.

Photo 213. 'Sensitive' and fragile details are typical of the RLC. A ramp transforms into a flat floor along an edge ending in infinite thinness. The result is inevitably flimsy, and symptomatic of the disconnection of design from building practice. July 2012.

The desire to make materials meet without any form of seam or joint, mark the design of the interior finishing. Therefore, one will not find protective trims on floor-edges, steps, or walls, and as a result, such locations rapidly show wear and tear (Photo 212 and Photo 213). In addition, the lack of trims, seams, and joints makes easy repair impossible. One cannot simply replace a trim, but will have to paint the whole wall or replace stretches of carpet. As this requires investments beyond the regular maintenance budget, repairs take place less frequent than needed for a good appearance.

The operable partitions of the Rolex Forum are too fragile to lean against, as visitors sitting on a beanbag tend to do. The partition's mechanism includes a thin pin under each panel, held by a U-shaped rail in the floor. The pin is too flimsy to take a horizontal load. As a remedy, management has posted signs with "Leaning against the panels is prohibited" on every third panel, but as visitors do not know or understand the background of this message, they mainly ignore it and even choose to sit against a panel bearing the sign. Engineers apparently were not aware of the effects of a 'beanbags-in-landscape concept', and designers have not thought of it either.

The beanbags themselves have become iconic for the popular RLC and its landscape concept. As a result many bags get stolen, and the ones left in the RLC are stained or punctured (Dufour, 2012).

Provisions for People with Disabilities

One of the main architectural features of the RLC is its representation of the Swiss landscape. As Switzerland is a mountainous country, the floor of the RLC is a composition of slopes, valleys, ridges, and a few level planes. The main provision for people with disabilities therefore is a network of level or near to level paths. Zigzagging ramps and plateau lifts connect the lower and upper levels. Surprisingly, this network of assisting paths does not connect with designated work areas. For a blind person, guidance is available for finding (non-Braille) books, not a table and chair.

Visually Impaired

Texture striping in the flooring marks level routes in the landscape, i.e. on ridges and in valleys. Assistance consists of an enigmatic concept of posts saying, in writing (!): 'Braille and audio available on backside.'

Wheelchair Users

Many of the slopes are steeper than recommended for wheelchair accessibility. Three ramps of acceptable steepness make series of hairpin bends, just like in mountain roads (Photo 214). The bends however are that short they are more like folds, and the resulting pattern is one of saw teeth rather than supple hairpin bends (Photo 211).

Photo 214. Wheelchair ramp folded into hairpin bends. The floor along the windows on the right is too steep for a legally acceptable escape route, hence the indicator in the floor recommending the zigzag route. June 2012.

The texture striping for the visually impaired turns out to be a hindrance for wheelchair users. As wheels meet different resistance on the felt carpet and the plastic striping, navigating requires special attention and additional effort. Moreover, it is hard to avoid the striping, as the level paths are approximately 120 cm / 4 feet wide and leave no space to drive a wheel chair well away from the striping. Wheelchair users can only avoid the striping by using the slopes, which is uncomfortable and potentially unsafe.

Several wheelchair toilets are available in the building's basement, accessible from the main floor via elevators. Two toilets are available on the main level, one having a structural support in an unexpected position, the other having the washing basin over the toilet bowl. The aesthetic intention of the architects to make rooms appear as bubbles in the landscape caused that inconvenience. As the floor plan of the room is a small quarter circle, only two straight walls are available. Mounting all necessary sanitary equipment in an adequate layout however, requires at least three straight walls. An acceptable layout with two straight walls would only be feasible in a much bigger (and less economic) room.
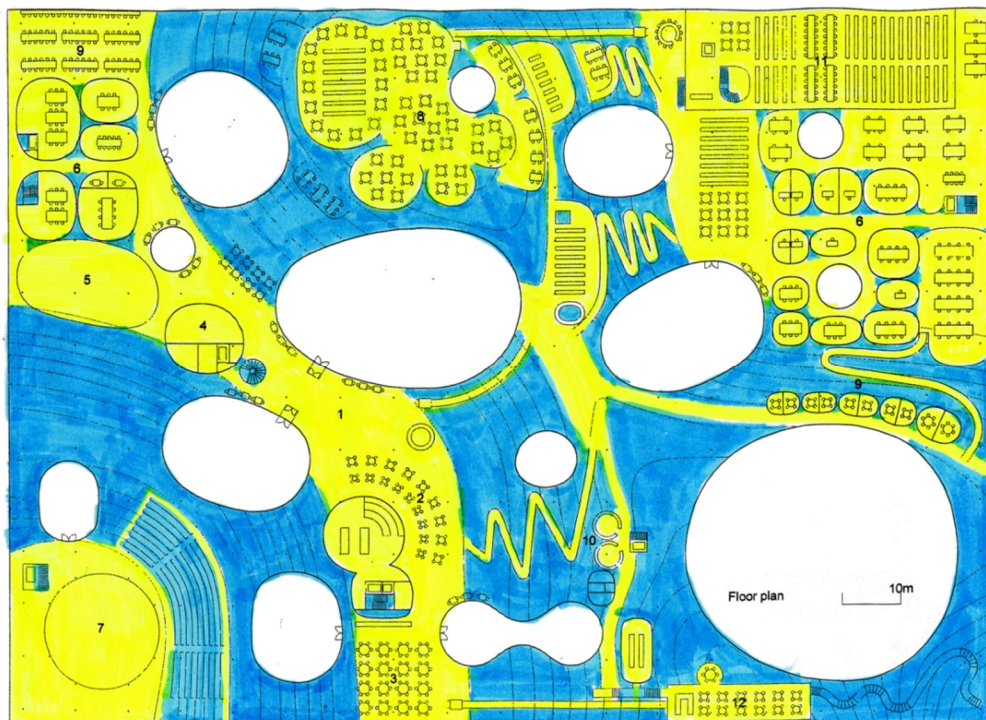
Drawing 34. Floor plan of the RLC. Yellow areas are accessible with wheelchairs and trolleys. Most of the blue areas do not comply with Swiss building codes, i.e. are too steep even for non-handicapped people. White bubbles are exterior space. Drawing by RLC design team, analysis and colors added by SdM.

The floor area affording use of wheelchairs and trolleys makes only a small portion of the whole building (Drawing 34). Building codes allow a maximum 6% slope in wheelchair accessible areas. The design expresses a limited vision on accessibility as it only affords narrow connections of functional locations, and does not embrace the

common concept of indiscriminate access. Analysis by EPFL's project team revealed that usable space makes only 36% of the building, and only 40% of that 36% (=14%) is in use as library, its initial purpose.

Security

In the RLC, the variety of functions requires different security policies. In general, the RLC is a public building allowing access to everyone, from 7am until midnight. The library of course requires a security system on the lending of books, i.e. a barrier around the book stock that non-registered books cannot cross without being detected.

Photo 215. No-man's-land on a slope as protection of the library. The man in white T-shirt is violating the rules. This 'solution' of a security issue is typical of non-interdisciplinary (i.e. fragmented) design strategies. June 2012.

Realization of a consistent barrier around the library is contradictory to the open landscape concept, and this has become visible in the concretization. Registration of books is checked through an RFID-system with detectors at the exit, which stands within action range of staff working at the information desk. Most of the library perimeter is already barred by a chain-wise positioning of the barriers needed to prevent people falling off the level floor areas. The remaining thoroughfares however would require RFID-antennas and permanent monitoring by staff, of which the latter is not feasible. Therefore, these thoroughfares are blocked with plant-boxes, which is a questionable measure regarding escape safety in case of fire. In addition, as books can easily be handed over to someone at the other side of this barrier, a parallel second barrier is placed at the down end of the slope, creating a more than ten-meter wide

area that is kept entirely empty (Photo 215). Social control keeps people from crossing this 250m² virtual field of fire. Despite its improvised look, the system appears to be effective as is proven by regular inventories of the library, showing theft is very rare. The use of plant-boxes and blocked space is a conspicuous compromise between the open landscape concept and security requirements.

Offices are obviously not public space and therefore screened off with fences and gates. One of the bubble-shaped rooms with an open top has netting spanned as a ceiling to keep undesired visitors out.

Entrance to the building is limited to the main entrance, a secondary entrance to the library, and the entrance to the Rolex Forum. None of the other doors in the facades do affords access. Seemingly as part of the security policy, they are kept locked at all times. For the library and the offices, this makes sense, for the public part of the building however, this is of no use as there is no security issue between interior and outdoor public space. Neither is it in line with security policies of other buildings on the EPFL campus, which normally allow access through such doors. This inconsistency has led to disobedient behavior by workers. Doors were found kept open with chairs and other equipment where they provide considerable shortcuts in routing. Office workers save themselves a detour via the main patio, main entrance, walk up- and downhill. Those who park their car in the basement enjoy the same advantage and have a much shorter walk to their office elsewhere on campus.

The normal behavior of people entering and leaving the RLC seems to fit exactly with the architectural concept: a landscape that continues in the surrounding campus. It is unclear why the security policy moves in the opposite direction.

Safety

Emergency Egress

The enigmatic security policy and its frequent breaches have inspired management to put up signs on all the emergency exit doors saying, "No exit, door under alarm, do not use this door." If indeed it were only the cat and mouse game it seems to be, this would not be too serious. In the perspective of fire safety however, such signage can become literally disastrous, as the behavior taught by it is counterproductive in emergencies. Not only do people put furniture in otherwise unused empty space in front of emergency exits, they also tend to not use such 'do not use this'- exits in an emergency and leave the building via the normal route, even when it is blocked by smoke. This means that if people do not use these doors under normal circumstances, they will not use them in emergencies either. Studies like (Kobes, 2008) have shown more discrepancies between common evacuation schemes and actual human behavior. For example, in an emergency, people in a department store will want to pay for their purchases before leaving the risky place, as they have come to buy something, not to escape a building. Anyway people generally escape via the routes they are familiar with,

i.e. not through doors that are under alarm and not to be used (Nederlands Instituut Fysieke Veiligheid, n.d.).

Photo 216. Signs telling people NOT to familiarize with the escape route. June 2012.

Photo 217. 'Do not use this door!' is an example of a conflict between formality and affordance. July 2012.

The architectural concept of the RLC, a landscape that has many connections with the surrounding campus, is an inherent sensible design for emergency egress. Making this scheme work requires that people use it as part of their daily routine and observations showed that they indeed prefer to do so. Frustrating this routine with arguable security measures compromises its effectiveness and creates potentially dangerous situations. One can understand why safety could outweigh security, whereas the inverse should be impossible.

Headroom

The undulating landscape of the main floor and the concrete shell that defines it, sit on a site that is the opposite: a flat. As a result, the free height under the shell varies between zero and six meters. To prevent people knocking their head, areas with less than two-meter headroom are contrastingly paved with loose pebbles instead of sealed surface. The loose pebbles are easy to recognize for visually impaired people. They are also easier to apply and maintain as one can handled the pebbles with a long rake and does not have to enter the too low space.

Steel barriers prevent passage under edges of the concrete slab lower than two meters, as well as passage through the operating range of automated windows. The presence of

these barriers is motivated by liability concerns, whereas they disrupt the intended sense of freely flowing space. These safety measures compromise the tectonic of the concrete shell touching the ground in a light and sensitive gesture. Liability is apparently stronger than aesthetics.

Tripping

This gradually coming together of levels also occurs at many locations in the interior. In order to afford level placed furniture, several parts of the undulating floor are flat. Barriers are placed to prevent people falling off at the high end, while white striping and dots are applied in the flooring where the level difference nears zero and people might trip. Similar provisions are made along the wheelchair ramps.

In some locations, for example along the edges of the paths created for people with disabilities, the level floor transforms into the adjacent sloped floor with a considerable change in gradient. As these changes are visually inconspicuous, they are an easy cause of tripping.

Trolleys and slopes

Trolleys in the RLC are being used for books and catering supplies. For health and safety reasons, it is not allowed to use trolleys on sloped floors, as a runaway trolley might cause injury and damage. This restriction has a significant impact on the daily routine in a building where most of the floor is not level and the use of trolleys is part of normal procedures. A network of level paths, elevators, and plateau lifts provides slope-free routes for trolleys. As this network coincides with the provisions for people with disabilities, plastic texture striping is present in the flooring, which is inconvenient when using a trolley. This may look as a conflict of interests between two stakeholders, but is in fact due to the decision not to make level paths wide enough to offer space for both striping and smooth flooring. It shows how strongly the designers adhered to the architectural concept of the undulating landscape.

Acoustics

In a room, sound propagates either in a direct line from source to receiver or via reflections against the ceiling, walls, and floor. Usually, compartmentalization reduces acoustic nuisance in a large building. As quietness is a basic requirement in a library, designing the RLC as one big open space is a daring idea. The undulating landscape concept however, is helpful in noise reduction as it provides an acoustic labyrinth in which sound is absorbed. Propagation in the RLC is mainly depending on reflections against floor and ceiling. As both are covered with sound absorbing material, felt carpet, and acoustic ceiling, noise reduction is very effective. In addition, as there are no parallel or flat walls, the remaining sound is spread and reduced further with every reflection. Inside the bubble shape rooms however, the curved walls afford unfamiliar echoes.

Staff reported the normal nuisance of an open plan office. A special case is a room with an open ceiling. The director working in that room is not aware that in the adjacent open plan office, colleagues can hear his rather loud voice. The room lacks a window to that office area, and the director has no notion of the presence of others. The visually closed design of the acoustically open ceiling leads to a false sense of privacy.

Temperature and Ventilation

An automated system of operable windows provides ventilation. These windows are located in the many round patios and afford the use of luff and lee effects of wind passing the patios and the building. In addition, automated hatches in the high parts of the roof allow venting of accumulating warm air.

There are no operable windows in the perimeter façade. Office workers however tend to open the exterior doors although they are supposedly under security alarm (see *Security*). This creates additional ventilation in the corners of the building. An interviewee explained that opening these doors also occurs as exercise of personal control in a setting controlled by others. Besides ventilation, opening the doors offers an irreplaceable connection with the outdoor. Although the floor-to-ceiling glass façades afford a strong visual relation, only a real open door allows all the senses to perceive the outside world.

In the RLC, temperature is less an issue in summer than in winter. The natural ventilation increases tolerance to high temperature, as it is perceived 'part of the weather' as opposed to 'performance of the building's services'. Apparently, control by nature is more tolerable than control by systems. An interviewee pointed out that despite the natural ventilation, she still felt little in control since it is the building's system that operates the windows. The only operable item she could remember was a thin curtain around one of the patios. In winter, additional electric heating is installed by occupants, especially at information desks.

Closed rooms such as kitchens and sanitary are equipped with mechanical ventilation. Some meeting rooms that have a closed ceiling lack natural ventilation. Staff reported air quality issues. Mechanical ventilation in those meeting rooms is not sufficient and people put stand-alone fans in the doorway to force air circulation after meetings. Smell around catering areas is an inevitable consequence of the open landscape concept.

Light and Lighting

One of the most appreciated qualities of the RLC is the abundance of light. The proportion of daylight is high, although glare rarely occurs. A fully automated system of blinds moderates the access of direct sunlight. Nearly all spaces have daylight from two sides or more. Occupants report a sense of continuous contact with the rest of the world through the changes in daylight, wherever one is.

Lighting consists of centrally controlled general lighting combined with occupant-controlled local lighting on all desks and tables. Lighting levels in the beanbag-in-landscape concept are therefore not individually adjustable.

RLC as a Landmark

The primary purpose of the RLC is landmark building. The visual effect of its architecture has top priority and indeed all other aspects are of less importance. Consequently, the architect put the program of requirements as written by the client aside in the earliest stage of the project. The architect drove contractors, builders, and users crazy, but since the client's presidency feared reputational damage, all were told 'not to touch the diva'. An interviewee characterized the building as "a 1:1 scale model of itself" and "it is only designed for the photo. The building's main quality lies in its visual sentiment".

Part of the landmark effect comes from the design style typical of SANAA architects, i.e. from the explicit presence of the architect's self. This strong self was not only present in the design and build phase of the project,[51] it is still present today. The building does not afford changes or flexibility. First, the architect does not allow any change, and second, it is physically impossible to move whatever element. Rooms have shapes that do not allow extension. Water driven floor heating is one of the many obstacles. Exhibitions (which potentially disturb the visual quality) are almost impossible since displays cannot be mounted and the sloped floors require costly custom-made solutions.

The RLC serves its purpose as landmark and draws many visitors and tourists. Priority of the landmark aspect, and the consequent downplay of other is reflected in the assessments people make of the RLC. Appreciation is high under visitors who spend only a short time. Students, who spend more time in the RLC, feel attracted to the visual qualities but report practical issues and crowding. Fulltime occupants report persistent climate and comfort issues.

Discussion

In this study, a range of design aspects and their importance to the project were investigated. The architecture is a reflection of all these aspects. Studying them separately, affords deconstruction of the quality of the whole. The performance as a landmark is high: the RLC draws many visitors and has become iconic of EPFL, as intended. The visuals of the architecture are strong and appealing. Even in busy exam periods, students prefer to work in the RLC, despite the presence of too many people.

The hilly landscape floor is a daring idea, as is having one big open space in a library where silence is the norm. The undulating space turns out to be an acoustic labyrinth

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[51] See also: (*Le Paysage Intérieur 2007-2010, la Naissance du Rolex Learning Center EPFL, Lausanne,* 2011).

that effectively traps sound. Some of the steeper slopes are left empty and serve as theft barriers under social control. Functions that require level floors however, are short in room. Apparently, many functions belong to this category; among them are the use of wheelchairs and transport of goods on trolleys. Although Swiss building codes do not exclude sloped floors from calculable accessible area, most of the building should be considered inaccessible for wheelchair users. Sitting in a wheelchair on a slope is too uncomfortable and transport is forbidden for safety reasons. Acceptable accessibility is created with legal loopholes rather than reality. In the framework of this thesis, symbiosis of wheelchair users and the building only exists in the formal dimension.

The RLC is a landscape in itself and intends to be continuous with the surrounding world. The glass facades afford a visual connection and the natural ventilation supports perception of the outdoor through many senses. The proximity to the outdoor climate seems to contribute to the tolerance for fluctuations in the interior temperature. The presence of daylight throughout the building also contributes to maintaining a connection with the outside world.

Regarding fire safety, the architectural concept of an interior landscape continuing into the outdoor is a sensible idea for a safe building. An enigmatic security policy however is compromising this safety by inhibiting occupants to familiarize with emergency exits. The imposed security-policy shows no logical connection with the design and actual use of the building and seems foreign to the project. One can understand that safety outweighs security, whereas the inverse is impossible. Like the accessibility issue mentioned above, the formal dimension seems to have taken a life on its own. Moreover, safety and security have no connection either.

Building use and maintenance apparently have been less decisive aspects. Maintenance has issues with accessibility and sensitive technology. Certain materials and forms are incompatible with cleaning and repair. Wheelchair accessibility is limited to paths that connect certain functions, whereas regulations aim at making as much space accessible as possible.

After an early survey of the hierarchy of design topics, *goals, space visuals, material systems* and *tectonics* were expected to be of 'topical' importance, whereas *use* was expected to be no more than 'considered', and *maintenance* and *change* would even be 'default' aspects. Detailed research showed that the topical aspects indeed contributed greatly to the overall performance of the project, whereas the aspects that got less attention are now the areas in which the majority of problems occur. These problems then again affect the topical aspects. For example, maintenance issues affect the visual aspects. It shows that equilibrium between all design aspects is required to ensure the quality of the project. Debates about the RLC are often on practical issues versus its high profile architecture. The latter is brought up by the defense as to compensate for the first, whereas this would not be necessary in a project with a less lopsided hierarchy of design aspects.

Conclusion

The Rolex Learning Center as an example of today's high tech architecture shows that disciplines involved in design, construction, use, maintenance, et cetera operate independently to great extent. Consequently, communication between parties seems minimal. Not only is the hierarchy of design aspects lopsided, it is fragmented as well.

The design aspect of *Goal*, i.e. the ambition to create an architectural landmark, has led to an inflation of the built volume. The undulating floor can only be justified as an architectural gimmick. It puts however restrictions on all other design aspects: *Program; Space Visuals; Performance; Specification; Material Systems; Tectonics; Fabrication; Testing; Assembly; Site; Use; Maintenance; Change; Coalition; Operations; Procurement; Resources; Stakeholders*.

Various physical and formal measures harness ordinary human behavior. Since various conflicts of interests between design aspects have not been resolved, they have taken physical form in unusual room and furniture arrangements. Together with the introduction of formal measures and the absence of physical flexibility, these 'solutions' have made the RLC harder and more rigid than the open landscape concept suggests.

Besides the effects of the undulating-landscape-concept on the affordance of human behavior, the unusual design came with considerable challenges regarding legal requirements. The many zigzagging ramps for example serve little other purpose than complying with formalities. Strict interpretation of building codes and bylaws has led to the situation that all required functions in the RLC are indeed accessible for wheelchair users and visually impaired, although much of the other space is not, and can only be perceived visually. The formal context therefore is present as a literal interpretation, not as a concretization of its intentions.

UNIL Géopolis

Photo 218. Géopolis, recently built on the Lausanne University campus. September 2, 2013.

Géopolis is the newest building on the campus of the Lausanne University (UNIL). It is the combined home of humanities and earth sciences, two disciplines with little in common and initially insisting on each having their own building. Géopolis was the last case study in the series of fieldwork research conducted for this thesis. Since theory was already emerging from the previous case studies, the focus of this case was on the formal dimension of symbiosis in order to identify the effects of both technological and formal maximization.

Research design

The research was conducted in collaboration with Dr. Daniela Cerqui, who is an anthropologist specialized in the phenomenon of 'cyborgism', i.e. the human body being 'enhanced' with technology. Dr. Cerqui has her office in Géopolis.

In the first phase of the case study, the building and its features in the perspective of the symbiosis concept were surveyed. This survey took place before conducting interviews with people, in order to bridge a potential knowledge gap between the researchers and informants. The survey focused on the material, the personal, and the social dimension. First, the focus was on the buildings technical design, i.e. its rapport with current architectural practice. Second, potential issues regarding what the building affords to its occupants, were identified. Third, similar to the second, potential issues regarding social affordances were identified.

In the second phase, people who frequently use the Géopolis building were interviewed:

Faculty, i.e. people with a fixed daily workspace;

Students, i.e. people with no fixed workplace;

Health & safety coordinator, facility managers, i.e. people managing the building;

Architects.

All were interviewed in guided conversations, an interview technique described in **L'ENTRETIEN COMPRÉHENSIF** (Kaufmann, 2011). With this technique, the informant is encouraged to talk while the interviewer gently guides the conversation along predefined topics without having to follow a linear order. The interview started with asking the informant to describe his/her average day in Géopolis. The interviewers looked for indicators of the dimensions mentioned above, and guided the conversation when needed. The observations made in the survey of the building were kept hidden from the informant.

Description of the Building by Survey

The overall shape of the building is a straightforward rectangular block, with a façade consisting of floor-to-ceiling windows, alternating with ditto steel panels. The building's height is five stories and a basement. The entrance is on the first floor (= ground level), whereas the second floor is where most circulation takes place. Because of its size, the building is equipped with four atriums, reaching from the second floor to the roof, topped with skylights. The layout (see Drawing 35) of the upper floors consists of three parallel corridors lined with offices. In the center of the building is a wide circulation area including open stairs, staircases, elevators, pantries, and toilets. About half of the rooms have a window to the exterior; the others are dependent of the atriums for daylight. The long corridors receive almost no daylight since partitions have no glazing, nor do doors. For fire-safety, the building is equipped with a sprinkler system and self-closing fire doors.
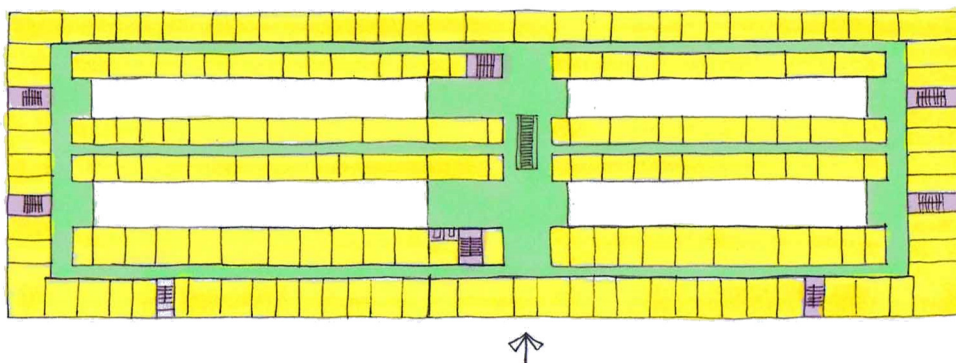
Drawing 35. Four atriums (white) mark the floor plan. Offices (yellow) line the corridors (green).

The building's structure consists of concrete slabs born by concrete columns. The raised flooring contains the building services. Ceilings are of exposed concrete, partly covered with sound absorbing panels. Interior façades (office to atrium) are fully glazed. Windows are not operable to the exterior, or the atriums.
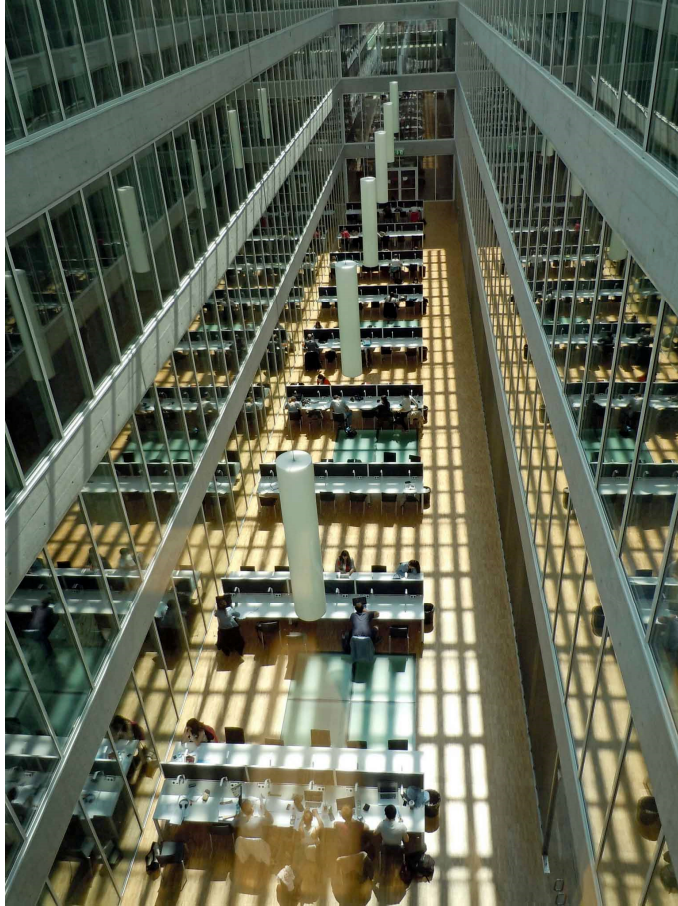
Photo 219. One of the four atriums serves as study. September 2, 2013.

A centralized system manages the temperature. No individual control is available in the rooms. If necessary, the facility manager can adjust the temperature through changes in the ventilation system. Systems are set according the average occupancy of each room. Desk lighting is switched off automatically when to little activity is detected for a prolonged time.

All office doors are equipped with door-springs and electronic locks.

Description of the Building by Informants

The interviews revealed that significant differences exist between the stories of the four types of informants, whereas informants belonging to the same type produced roughly the same information. The collected data will therefore be displayed and discussed in a thematic way, in order to identify the patterns that cause differences and similarities.

First, the four types of people each have their own relation to the building.

Faculty and students are end-users, whereas architects and building management are the people behind the scenes who create and run the building. In the symbiosis of the end-users and the building, architects and building management pull the building's strings.

Faculty differs from students regarding the time they spend in Géopolis. Students are visitors with no fixed workplace; their adaptation to the building follows from their nomadic status. Faculty has a fixed full time workplace and has less room to maneuver in optimizing their situation.

Architects and management are in a sequential relation to each other. After construction, the architect has to leave it in the hand of the other. The architects base their design on envisioned behavior, whereas the building management has to navigate the reality of practical, legal, and political issues. Architects and management are respectively the building's parents and foster parents.

Second, the various responses showed that there was not just one single shared understanding of the building and its use. As explained in Philosophical Approach, the relativist view is more appropriate for this case.

Personalization

Both faculty and students pointed out that Social Sciences seemed a bit out of place in this building. When asked if the character of Géopolis fits with the institute, responses were, "Géopolis is perfect for a tax office, or for prosecutors, but not for an institute of social sciences. It is too squared. Our spirit is not suitable for squaring" and "It is strange that Social Sciences are housed in Géopolis. The building is more representative for a company like Nestlé." The building is foremost suitable for short stays; i.e. for students and conference visitors.

Those who have a fixed office mentioned restrictions on personalization. Initially, bringing plants into the office was forbidden. After strong pressure however, it was eventually allowed. It is not allowed to put nails in, or otherwise damage walls in corridors. One can put up posters with magnets on a metal rail. The rail however, is too high on the wall. This maintenance policy affects personalization. In Anthropole, an informant had her much-loved wooden desk, she went to work with pleasure, she was allowed to arrange things herself, and the atmosphere was a bit 'savage'. In Géopolis, one is not allowed to bring personal furniture.

Students were little bothered by personalization and said the building reflected their modern lifestyle. "I study better in a modern building than a convivial building." Also, "its name is nice, it looks good. It is my favorite building and representative of modern UNIL."

Photo 220. Designated poster wall in the central circulation area. September 2, 2013.

The architects aimed at a building being a platform for much social life, with personalization as important ingredient. The glazed facades in the voids would show personal choices in furniture, curtains, et cetera (Photo 221). The thought of the circulation space around stairwells and elevators as filled with posters, stools, couches, pool tables, baby-foot tables, copiers, et cetera (Photo 220).

Curtains

Faculty explained that offices are equipped with sliding textile screens. The number of screens is one less than the number of windows. Consequently, one window remains uncovered. Some people find it uncomfortable that others can see them from higher floors. At the second floor, daylight in winter is too little and one cannot experience changes in the weather. "The light well does not work as it should". One of the informants removed the curtains in order to improve daylight access. The resulting openness is not problematic.

Regarding control, students mentioned the double face of the panopticon effect in Géopolis. Since many rooms have windows from floor to ceiling, social surveillance is strong. Many things are 'regulated by neighborliness'. As a result, there is less feeling of 'big brother' in the building, i.e. control by an anonymous entity. The office of one of the students associations also affords use for studying. The room has more curtains than other offices. Moreover, "I have no problem with the openness since I don't have a fixed workplace here."
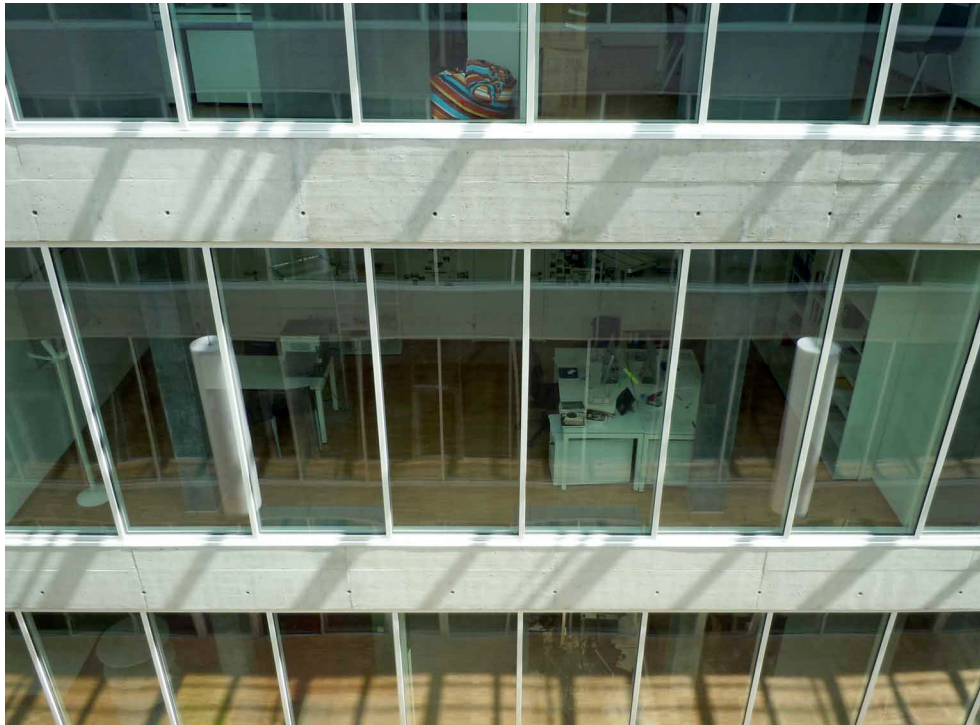
Photo 221. View across the atrium into other offices. September 2, 2013.

The architects deliberately chose dull and few curtains so the end-users can bring their own curtains in order to give a personal touch. The atriums would then show a diversity of curtains. Somehow, this is not happening.

Key Cards and Door-Springs

Access to the building is managed with badges, which one has to validate every seven days. Finding oneself locked out is a recurring and frustrating event. Wearing the badge on a ribbon around the neck is a practice many faculty dislike. The pressure on revalidating the badge regularly comes from the fact that room doors shut and lock automatically. This creates feelings of imprisonment. Visitors cannot open a door from outside; the occupant of the room has to come to the door to open it from the inside. A simple 'come in!' does not work. When one forgets to take his card when leaving the room, one is locked out. With the help of colleagues however, it is possible to unlock the door. To most faculty members, it is unknown why all doors are equipped with door-springs. Initially all room doors were equipped with door-springs, and it was not possible to leave a door open. Hence, people disable or remove door-springs.

Students too find the security system unpleasant. The required revalidation of electronic identity cards is a result of debates on privacy. Information on presence and authorizations of people must be erased from the system (i.e. 'big brother') regularly. The combination with the automatically locking doors is inconvenient. Access is restricted. People turn to the use of obstacles to keep door open. "The central corridor with all its closed doors reminds me of Titanic" (Photo 222).

Building management gave a different perspective: regarding the door-springs on office doors, there are indeed no obligations to have the doors shut. They are installed in order to create a situation that by default prevents theft. It is allowed to disable door-springs and people indeed do so. Office doors are equipped with key cards. Initially there were complaints about this system since it could compromise people's privacy. The electronic locks however are not online or otherwise capable of recording use patterns. The mere reason for installing the key-card system is costs-efficiency. Decommissioning and replacing a lost key-card is much cheaper than replacing cylinders and keys.

Regarding the many locked exterior doors in the restaurant's facade, building management explained that the order in which such double doors must be closed caused problems. The façade contains five sets of double doors opening to the exterior. The intention is to afford an open façade to the terrace. However, people used the generously big doors also for sneaking in and out in winter. When a set is closed in the wrong order forcefully (as happens in windy conditions) locks are damaged. In practice, the slamming of the doors was problematic. Therefore all doors, except one, are now equipped with systems that only allow use as emergency exit. The continuous slamming of the door between the main entrance hall and the restaurant, worsened by the kitchen's air handling system, led to a similar permanent closure. The result is that the grandeur of a restaurant-cum-terrace is lost. In exchange, the restaurant is now equipped with an abundance of emergency exits.

The architect's perspective on this matter was less concerned with practicalities. The main entrance hall is designed to serve both the cafeteria and the rest of the building. Unfortunately, the door to the cafeteria is now locked. The many doors in the cafeteria façade are designed to connect the space with the exterior terrace. Since the building has about 920 internal doors, the general contractor argued that diversity in door design would make the project too complicated. All office doors are now identical, and equipped with door-springs.

Couches

Couches, preferably a bit worn out, are emblematic of student environments. Students explained that couches are an indicator of the social 'ecosystem'. In Anthropole (the former home of UNIL's Social Sciences) for example, the use of 'non-normalized' couches is widespread. Attempts have been made to replace them, under the pretext of safety, in order to make things look tidier. There is however, a certain margin of freedom regarding the application of norms. In Géopolis, in an attempt to maintain uniformity, private furniture is not allowed. A practice one student called, "no participatory governance of furniture". In student association's offices though, couches are allowed, but must not be put along windows in order to avoid damage to ventilation grills (in floor).

The architects as well had couches in mind regarding appropriation of the building. The area in the center of the building is for social life. They could hold all kind of items, like couches et cetera, which the architects would be happy to see. There is however, a limit on the amount of burnable material that may be put here. In addition, in case of fire, automated sliding partitions will close certain areas off. There are concerns over that furniture might compromise these measures.

'The Architect'

Somehow, people tend to blame the architect for everything that affects their symbiosis. For the end user, the architect is the embodiment of 'the others'.

Faculty explained that smoking is not permitted in the Géopolis building. The smokers' area is outside, at the dumpster park. An informant said the architects did not want to create a smokers area at all. *[When asked if it was indeed the architect or perhaps the UNIL presidency, informant did not confirm it was the architect].* Another informant asks herself if the architects had any idea of what people in the building actually need. Apparently, the architects had no idea of what type of furniture scholars normally use. Or: if the architects had any idea of whom the building is built for. "Have they ever visited a university?" and "Nothing has been thought of".

 Moreover, some faculty found meetings with the architects and engineers not very fruitful. Atmosphere was sometimes grim. End-users will have to adapt to the building as it is.

Students too blamed much of what they did not understand to 'the architect': "The architect's logic is incomprehensible. Why are photocopiers and printers not put in corridors? Where is practical common sense?" "The entrance hall is much too big. The entrance door of the cafeteria is too narrow. The direct door between entrance hall and cafeteria is always locked."

The architects themselves pointed at the limitations they face. In the design phase, the architect spoke with future occupants, mainly with the deans, building management, heads of the laboratories and the libraries. In order to afford decision-making, discussions with too many people had to be avoided. Besides the practical needs of users, building management was a major topic in discussions. The architects presented the design to end-users in several presentations. Users had many questions, to which often the answer was that "not everything is possible".

Operable Window

Absence of operable windows is a guarantee for debate.

Faculty claims ventilation in Géopolis is problematic and many colleagues report headaches. Consequently: people come to work with reluctance, especially on Monday after a weekend of fresh air; people take their work to somewhere else on campus; occupants do not invite people in the building but somewhere outside; a colleague

rents an office somewhere outside Géopolis; social life suffers from less contact; some have applied for permission to work at home one day per week.

Ventilation in rooms is set in accordance with the number of occupants. When an occupant of a single person room receives two guests for example, the climate in the room rapidly deteriorates. Since windows are not operable and doors kept shut, the situation is soon problematic.

Some informants mentioned the absence of operable windows as by far the biggest issue they have with the building. Operable windows are not only about fresh air, but also about the connection with the outside world and its dynamism.

In winter, air is too dry and faculty experience skin problems. Nowadays, people install household-type humidifiers, as recommended by the H&S coordinator.

Building management explained that due to bankruptcy of the general contractor, several subcontractors and suppliers disassembled and took back what they had delivered. Other parties where then contracted to finish the building. As a result, builders had to continue work initiated by others, combining elements of different make and model, and the number of parties involved in the project nearly doubled. Warrantee agreements became very complicated.

After two years of adjustments, complaints about temperature have become rare. Initially, complaints were dealt with by checking the overall system and making adjustment where needed. Nowadays, the approach is the other way. In response to complaints, the situation at detailed level in the individual room is checked. Often ventilation grills appear to be blocked, or mounted in the wrong direction. From that level upwards, the problem is analyzed and handled.

A remaining problem is humidity, which in winter can drop below 20% RH. A heat recycling system heats incoming fresh air. Since cold air contains less water than needed for sufficient humidity at ambient temperature, the building inevitably dries out. Traditional mechanical systems humidify air centrally before distribution. Such systems however, are breeding places of pathogens causing the sick building syndrome (SBS). In order to tackle the humidity issue without risking SBS, building management hands out non-fixed humidifiers where necessary. The advantage of this strategy is that it puts the office worker in control of his own situation, thus reducing complaints.

The building has no operable windows. The security manager mentioned security and interior climate as justification. In addition, in rooms with several people and several windows, negotiating would become complicated. When one would open a window, it would probably cause more draft over the others than the person himself.

The architect considers operable windows essential for connection with the environment. Building management however, argued that having to check and close all the windows every day is too much work. They also rejected the solution of automated

windows since "people might put objects in a way obstructing the window system". For fire safety reasons, windows around voids are not operable.

Sociopetal

To what extent does the building support social activity?

All informants mentioned the cafeteria and its problematic acoustics. It is too noisy, even with few visitors. After complaints, sound absorbing baffles have been installed but with limited effect. Zelig, the students' bar in Géopolis, is convivial and is a refuge for staff and students alike.

Both faculty and students mentioned purchasing lunch in the cafeteria and then take it to another place for consumption. Many expressed their dislike of the long daylight deprived corridors. Social talk in the corridor is avoided since conversations can be overheard in the rooms. "Conviviality has gone". Staff from administration department has asked management to provide windows in doors.

In Anthropole, classrooms are located on all floors. This affords all kinds of occasional encounters, whereas in Géopolis all takes place in a 'programmed circuit.' As heart of the campus, most informants mentioned the library, known as *le Banane.*

Building management has observed an increase of aggression in Géopolis, at the cost of conviviality.

Photo 222. The office corridors do not support social activity. From it, one cannot perceive the presence of people in the adjacent rooms. September 2, 2013.

In order to create a sociopetal environment, the architect aimed at much openness in the design. In office areas, windows in or next to doors would allow daylight and visual contact. Hopefully, occupants would leave their door open. The architects equipped the staircases with open doors, in order to give exposure to activity. Today however, fire doors of the staircases are permanently closed, whereas they are equipped with door-springs linked to the fire alarm. Building management could not explain why the doors are always shut, but said on personal title that the abundance of exposed concrete made the staircase not so attractive to look at.

Cost reductions and untraceable management motives compromised this intention of creating an open environment. All doors are now identical and without glazing. Hence, the sociofugal character of the office areas, where there is no daylight and no noticeable presence of colleagues. There is no obligation to have door-springs.

The Manual

When new people get a workplace in Géopolis, they receive a manual of the building, together with some guidelines. In the early days of Géopolis, users were frequently educated (by e-mail) how to comply with *Minergie*-standards. It is not allowed to put furniture in front of windows. Grills in the floor should not be covered at any time. It is not allowed to stick any poster or paper on windows. When asked about authority to change things, an informant responded that '*on n'a pas de marge de manœuvre,*' i.e. one has no room to maneuver. Asked about a possible 'urge to act' she said she had given up. She does not have the energy to take action.

The sheer length of the corridors and the consequent large number of (identical) doors makes signage with names and room numbers indispensible, even for those well familiar with the section. Personal items on doors do contribute to way finding; nevertheless, one is much dependent of the signage system. Navigating by other indicators is not possible.

UNIL management regularly organizes information meetings, in order to tackle problems.

Students know of the existence of the manual.

Autonomy – Heteronomy

In the symbiosis, one is dependent on the decisions taken by others, and thus autonomy has its limits.

Faculty pointed out that office rooms are allocated by job title and hierarchical position, not by daily presence. Consequently, fulltime present administration has their office far away from daylight, while always-on-the-road professors enjoy exterior windows with a view. Getting a better room is almost impossible. Also on detailed level, heteronomy is tangible: women have asked for a small shelve in the toilet room to put their handbag on. It took two years to get it.

The move of students' bar *Zelig* from the Anthropole to Géopolis caused much debate. Associations and occupants are moved around, since they are lowest in the hierarchy. Institutions and staff get priority in the designation of rooms.

A student called the presence of refrigerators and couches in the students association's office is 'exceptional', whereas faculty labels it 'subversive'.

Faculty responded negatively regarding their autonomy, whereas students tended towards "one has to adapt to the building".

Building management mentioned that some people tried to hold them responsible for ventilation and humidity issues. The direction however declines such claims since they are bound to running a Minergie and ECO+ labeled building, although such norms are not compatible with Swiss laws on labor conditions (particularly *Lois du Travail* 3+4). Causes of problems therefore lie beyond management's reach. Moreover, certain regulations are simply not compatible with specific academia requirements. For example, certain biochemical labs require absence of daylight, whereas labor laws do not allow working in a room without daylight for longer than two hours.

Window blinds are controlled semi-centrally. At certain moments of the day, the building management system closes the blinds in order to create a thermal coat. People can block this closure at will or reopen the blinds. The aim is to have the thermal coat closed when rooms are not in use.

Personalization of room temperature is restricted since the cantonal government forbids the use of electric heaters.

Minergie

Faculty mentioned that offices on the second floor adjacent to the atriums, suffer from persistent shortage of daylight in winter. The problem is serious enough to get people looking for workspace in other buildings. It is an issue specific of Géopolis, and openly talked about among staff. People without a fixed workplace (students) and part-timers can work around the problem. Only people who are obliged to work in Géopolis, like administrative staff, are fulltime present and cannot escape. Building management explained their navigating different interests. Lack of daylight in winter in the lower parts of the building, is related to heat management of the top floor (fifth). Shutters over the glazed atrium roof keep the temperature at the right level, and consequently decrease the experience of daylight. After complaints, management changed temperature settings in order to reach better balance in comfort.

Similar to the A-One Business Center case, office workers observed counter-productiveness of some *Minergie* measures. First, automated taps keep running for quite some time after use, up to twice the time needed. Second, light switches off automatically ten minutes after one leaves the room. As a result, people do not switch off lights anymore. Consequently, lighting is left on for ten minutes at every break,

every meeting, every in and out. On an average day, this can add up to an hour. When energy consumption of humidifiers et cetera is taken into account, this *Minergie* building probably performs like an ordinary building.

Students noticed that automated lighting control might be a good idea for summer, whereas in winter it does not make much difference. Anyway, inside one cannot perceive the weather.

The architects explained that although law does not require a Minergie label, in practice it is almost obligatory. Laboratories are exempt of *Minergie* policies, as safety has priority and targets can anyhow not be reached. Because of energy efficiency, the architect had to change the initial façade design (double glass façade) into a single façade of which only 50% glazed (Photo 218).

Discussion and Conclusions

Like all informants, the building management was dedicated to creating a convivial and pleasant building. Practice at the same time demanded concessions and compromises. Many of the surprising and hard to comprehend solutions appear to respond to hands-on practical problems. From that perspective, the situation is logical whereas from the perspective of the unaware user, the results seem odd and contradictory. The perception of what makes 'common sense' depends on the role of the perceiver.

Building management summarized the task of keeping users satisfied as having to navigate between certain extremes that occur in the building; the limited range of adaptability of the building; and above all the fact that not everything is possible.

In order to reduce costs, the contractor aimed at uniformity in production, i.e. the opposite of diversity. The price of these cost savings is the loss of the transparency and sociopetal quality the architects had put in the design. I.e., commodification is stronger than the personal and social dimension.

The building management seems to prioritize potential liability over human comfort. I.e. the formal dimension is stronger than the personal.

Especially the way windows, doors, and locks are treated, witness of a tendency to exclude the end-user from operating building elements. I.e. technium takes over from people.

Over-division is the cause of the daylight issue in the offices on the second floor adjacent to the atrium. The atriums aim at providing daylight in all offices; the roof must keep the temperature right; organizational hierarchy does not allow prioritizing full-time workers in room allocation. These three aspects are part of separate domains and thus cannot generate sufficient urgency for an overall solution.

The presence of a user manual for the building is emblematic of the symbiosis in several ways. First, it is the manifest of an apparent intention to make occupants enjoy all that the building has to offer. In accordance with that, the building management appeared strongly committed to creating a great place to work. On the other hand, the presence of the manual suggests that understanding the building is not that straightforward. In particular, faculty had difficulty understanding phenomena that had their origins in far away domains. Typically, people condense all that is incomprehensible into 'the architect's idea'. Although all shared the same ideas of what the building should afford to its occupants, several factors hindered reaching this shared ambition. Contractors and financial cuts stand between the architects and the end-users. Between building management and faculty stand legal and technical limitations, and most of all, the plethora of stakeholders.

The smaller practical issues are mainly due to technium and commodification, whereas large-scale issues like non-operable windows, ventilation, temperature, and daylight, follow from organizational causes and the commitment to *Minergie*.

Summary

In all three cases, the buildings are more autonomous than buildings in vernacular environments. The role of the end-user in taking care of the building has decreased and is largely taken over by (i.e. outsourced to) 'professionals'.

In the cases of A-One Business Center and Géopolis, end-users identified compliance with the *Minergie*-standard as the cause of several issues they had with the building. Apparently, something as abstract and remote as an energy standard can be recognized by the end-user as affecting his comfort. This suggests that even in the complex setting of institutionalized organizations sharing a high-tech building, so little margin between elements exist, that regulations at one end of the chain resonate in the end-user at the other extreme. Moreover, it signals that policies and techniques for saving energy have reached their limits.

Regarding how symbiosis in high-tech buildings is different from vernacular, several patterns observed in the transitional cases have become even more apparent. The presence of a user manual, instructions by e-mail, and regular facility meetings are all markers of *accumulation* of affordances and technium. The observation that end-users nevertheless feel not in control , suggests that this accumulation does not reach the end-user effectively. The increase of affordances and technium requires a parallel increase of skills and habits. Apparently, certain end-users cannot keep up with this accumulation.

Division is visible between end-user and building management. Although they both aim at a pleasant working environment, their perspectives are different (and divisive). The end-user is one-on-one with his place, whereas building management operates behind the scenes serving multiple stakeholders simultaneously. Division also occurs between architect and building management. Although both work on creating a people supporting building i.e. facilitating the symbiosis, little overlap occurs in their involvement with the project.

Commodification has led to loss of architectural quality and user comfort. Transparency of the building and end-user autonomy, both use-values, were sacrificed for budgetary qualities i.e. exchange-values.

Low end-user control over everyday issues is a form of *hardening*. Fire safety, security, *Minergie* compliance, and increased complexity make it hard to generate sufficient autobiographical, physical, and social insidedness.

Overall, the projects are emblematic of *formalization*, in which the legal and the technium become leading. The architect ends up as scapegoat for the symptoms of the disconnection experienced by the end-user.

Findings

Dimensions

The findings from the literature research were combined in the four-dimension model of symbiosis as explained earlier on page 83. The model and its meaning as a finding will be discussed under Conclusions and Implications on page 349.

Trends

Since the central research question of this thesis investigates a phenomenon in a changing context, the findings are likely to be trends. This section describes the trends found in the results of literature research and fieldwork, categorized along the four dimensions of symbiosis. The five identified trends are Accumulation, Hardening, Division, Commodification, and Formalization. This chapter will discuss these five trends and elucidate how they manifest themselves in the personal, material, social, and formal dimensions of symbiosis.

Accumulation

With industrialization, the production of material goods has increased tremendously. The resulting material wealth allowed the human population to grow exponentially in the last century. Material growth followed population growth and actually surpassed it, i.e. the amount of material goods per person increased. Man accumulates matter. An easy indicator of this trend is house-occupancy, which has steadily dropped from six persons in vernacular households, to a good two in today's Western homes. The increase of material wealth also resulted in bigger homes. Combined with the lower occupancy rate, the amount of residential floor area per person has grown even more. In average, a person in Dharavi has 2 m² at his disposal, whereas in Amsterdam one has 50 m². The disparity becomes even bigger if we include the floor area built for amenities, offices, production facilities et cetera. The trend in the symbiosis therefore is one of accumulation, i.e. growth of the built mass per person. The proportion of people to built volume is becoming ever more lopsided. Consequently, the symbiosis has to adapt continuously and find equilibrium again.

People and Symbiosis

Regarding the implications of this trend for what buildings mean to people, Csikszentmihalyi and Rochberg-Halton (1981) point out that in 'development', a shift occurs from psychic energy to material energy. The psychic energy involves the

development of self through interaction with items in the household, whereas material energy is invested in signs of a powerful self in order to maintain a position in society, a behavior Thorstein Veblen (1899) identified as *conspicuous consumption* and even *wasteful consumption*.

Whereas context related materialism is of instrumental purpose, as is the case when it serves the common good or that of a person, the runaway urge to possess is what Csikszentmihalyi and Rochberg-Halton (1981) call *terminal materialism*. As the term suggests, they consider it a dead end, "A vital culture is one in which persons devote their psychic energy through continual cultivation and in return are given a broader conception of themselves".

As observed in the chapter about Wedding, the decrease of household size gives more room for the ego. The fewer people in the home, the more the ego can inflate. Accumulation of matter affords accumulation of ego.

Building and Symbiosis

As mentioned, material growth led to material accumulation. For one part, this resulted from cheap industrial production. Another factor however, is the spatial inefficiency of mass produced buildings. The analysis of stairs in informal settlement (page 206) showed that standardization comes with certain waste of space. As observed in Slum Improvement (page 280), circulation space is typical of multi-storied housing and functionalist design. It leads to further accumulation of space per person.

Functionalism segregated the use of space into separate functions. Instead of one multipurpose room, functionalism requires several rooms to cover all types of use. Consequently, the number of rooms per home has increased and with it the amount of space. Functionalism's segregation causes accumulation of rooms.

Furniture too has accumulating effects. As explained in the chapter on furniture (page 222), items like chairs and tables fixate functions to rooms and afford less variation in use. It thus stimulates accumulation of space. In addition, both diversification and specialization cause accumulation of furniture itself.

Besides the accumulation afforded by industrial production, the incremental development typical of informal settlement is a cumulative growth pattern (page 160). The main difference between commodified accumulation and vernacular accumulation is that the first is about collecting and assembling objects, whereas the latter is a generative process of accretion.

An inevitable result of accumulation is redundancy. In the framework of a 2014 *Unité d'Enseignement* at EPFL's faculty ENAC, students were asked to imagine themselves homeless and having to create their own shelter on the university campus. The students' proposals revealed an abundance of spaces and facilities in the university

buildings that afforded fulltime living on campus without drawing attention from others. Almost no one sought to build an informal dwelling outside.

Society and Symbiosis

The accumulation of built matter in the symbiosis is what affords society to identify people by their building. The more permanent the house, the easier it is to locate the occupants. As described under Homelessness (page 65), the lack of home makes that society has little hold on a person. The home and the house are anchors that increase with accumulation.

Since more matter means more exposure, the same accumulation makes people an easier target of violation of the home and domicide.

The accumulation of matter is also visible in censuses. Their sampling initially used geographical and social criteria, whereas in the twentieth century the focus moved to materialism.

Formality and Symbiosis

In vernacular environments, arrangements are made through agreements between natural persons. Such agreements do not reach further than the local context. With the introduction of formal systems, and certainly with uniformity and unification, the reach of agreements increases. Formalization thus affords the accumulation of context. Consequently, symbiosis becomes relevant to a wider context.

The side effect of this accumulation of formal context is that ever more agreements, regulations, and laws apply. Inevitably, some rules are not suitable for certain situations on the ground. The increase of the formal thus leads to dis-localization, or what Fiedler (2014) calls abstraction.

Accumulations in the formal and material dimension therefore add to the symbiosis itself since both the affected and affecting context increase. The symbiosis interacts with more contexts.

Hardening

The case study in India opened with a chapter on the trend of making *kacca* buildings more *pucca*, i.e. the trend of making buildings more durable. This trend is of all times. Hardening refers in the first place to the trend of using harder materials in order to reduce maintenance. The trend of hardening however is also visible in the other dimensions of symbiosis.

People and Symbiosis

The hardening causes people to be less in touch with their building. A soft building requires more care. Hardness and softness result from more than the material alone. It also occurs in building services. When people can operate services themselves, they

feel more in control than when confronted with fully automated services. In a soft building, people are *in control*, whereas in a hard building, they are *under control*. Similarly, hi-tech buildings tend to call upon adaptation skills of people, whereas hi-touch leans on adaptation of the building.

Ultimately, a building that affords no changes made by its occupants is hard and in fact excludes the people. One of the project team members of the Rolex Learning Center characterized the building as not designed for having users in it (*Le Paysage Intérieur 2007-2010, la Naissance du Rolex Learning Center EPFL, Lausanne*, 2011).

A strong symbiosis of people and building requires sufficient interaction between the two. Development of Self, self-determination, autonomy, and competence need a *kacca* environment, i.e. certain softness. Exclusion of the user leads to less tolerance to building, as stated in the Adaptive Comfort Hypothesis.

Interaction with the building allows the user to develop autobiographical, physical, and social insidedness. Through this, it affords the interlock of autonomy and heteronomy, i.e. a person and the world. Hardening hinders such psychological development.

An important factor in psychological comfort is the sense of passage of time. The appreciation of both change and constancy require awareness of time. Hard buildings and policies obscure the traces that people leave in buildings and thus witnesses of the passage of time. Patina, autobiography, meaning, insidedness, and de-alienation all work better when a building is soft enough.

Building and Symbiosis

Material hardening of buildings increased with the introduction of steel, glass, and most of all reinforced concrete. Steel and glass can be worked and deformed, whereas reinforced concrete cannot be changed once cast. It is therefore in today's debate on sustainability that this hardening is rightfully questioned, since it hinders refitting and recycling. Re-use of materials is only possible when future users can sufficiently adapt it to their needs. Inclusion of the (future) user is a form of softness. Hardening is exclusion. People who move from a traditional Indian *chawl* to multi-storied housing experience the building as hostile since the reinforced concrete does not allow them to make an extra window where they need it.

Functionalism hardens differences between uses.

Robotization and domotics too are forms of hardening since they exclude the user from operation. In a similar way, the outsourcing of cleaning and maintenance deprives the end-user of interaction with the building. Professional caretaking replaces the end user's personal input in maintenance.

Buildings are also hardening in the sense that they show increased demandingness resulting from mechanical development. Some building elements require competences

the average occupant does not possess. Automation aims at decreasing this demandingness but can again cause feelings of not being in control.

The ongoing application of non-operable windows is emblematic of hardening.

Society and Symbiosis

Besides physical hardening and the reduction of control, also the way users are organized can hinder the symbiosis. Organizations have policies that interfere with normal human behavior. For example, if an office worker complains about draft and the company does not provide the necessary means for adjusting the ventilation grills, it is the organization, i.e. the social, that hardens the building.

Prohibition of personalization too is a form of social hardening.

In a broader sense, societies promote concretization of the people-building symbiosis through the intention of housing everybody. Overall, they aim at the eradication of homelessness at best by providing homeless with shelter, at worst by criminalizing them. Nomadism is equally discouraged, as is the use of trailer homes. In the social order, a person linked to a sturdy, immovable home is easier to hold accountable.

The eradication of slums is another level of this concretization. Since the modern city communicates planning, design, and industrial production, informal settlement is the expression of what is no longer desired as 'normal'. Similar to the criminalization of homelessness, informal settlement is widely given bad press. Both phenomena are emblematic of society hardening its grip.

Formality and Symbiosis

Formality is more abstract than agreements made between natural persons. It replaces interpersonal understanding with an abstract construct. This is by itself a form of hardening. Since it involves standardization of ways of conduct for large groups of people, it does not allow adaptation by the individual.

The hardening effect of formality is visible where policies are in charge and take over control from people. The case studies on high-tech buildings showed that regulations on fire safety, energy efficiency (Minergie), and household policies tend to exclude end-users from operating the building. They harden the distinction between users and buildings. In contrast, inclusive strategies require occupant participation and afford improvisation, the soft approach of interaction.

The study on high-tech buildings showed that Minergie as one part of formality, created situations where technology had to be given an exclusive leading role. The only way to prove that Minergie standards would be met was to exclude potential people-induced disruptions of the planned energy consumption pattern. This means that regulations as one part of the formality dimension induced the application of another

part: the *technium*. Thus, it (formality) prioritized *technium* over people. High-tech building is a form of hardening.

As described in Informal World (page 79), formal systems play an important role in society as it affords the creation of structures serving the common good. By complying with the rules collected in the legal system, citizens become 'legal' themselves. Successful societies have inclusive policies in order to give as many people as possible access to the legal system. As mentioned, it is accurate to say that those who have no access yet, are *extra*-legal. Those who are inside the system however often are of the opinion that the outsiders are *illegal*. The latter term has the connotation of violating the law, of being a criminal. This automatism of labeling the extra-legal as illegal is typical of the hardening effect of formalization.

The trend of hardening as result of formalization is tangible in Incremental and Encroachment (page 247). Encroachment as 'to gradually cover more and more of an area of land'[52] is at first sight a *kacca* phenomenon; it is of soft character. The communal land found in vernacular environments is a soft zone, whereas in the modern world segregates space into private and public. Extension of the private is thus inevitably an encroachment on the public realm. Formalization and the abolition of communal space is a hardening that turns encroachment into something problematic. Encroachment means also 'gradually taking away someone else's […], rights, […]'[53], i.e. violating somebody's formal position.

Division

The research identified division as characteristic of the transition to modern. Perhaps its most known form is the division of labor, although functionalism and mass housing are equally valid examples. The following description of this trend will demonstrate how division also stands for fragmentation, compartmentalization, and disconnection.

People and Symbiosis

In the personal aspect, division has all to do with the emergence of self. Individualization is a matter of division. The literature research on the personal components in symbiosis produced the notion of self as a concept frequently used in environmental psychology. Home making is an act of self-realization and the home is a reflection of the self. The home is also an extension of self. This notion of self thus became an element in the questions prepared for fieldwork interviews. Several questions therefore dealt with 'the building as a reflection of the self' and 'the connection of yourself and the home'. In the fieldwork, many of the Indian interviewees hardly recognized (if at all) this notion of self. "Do you consider your home a reflection of yourself?" "No, it's not like that, I am just a part of the home. The

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[52] ("Cambridge English Dictionary & Thesaurus," n.d.)

[53] Ibidem.

home is like a god." Instead of the Western notion of self and individualism, the notion of connection and co-existence marked the responses in the interviews in India. Hindus explained the importance of co-existence with everything else in the world (including 33 million gods), whereas Muslims displayed even less notion of self and talked about 'all under God'.

In THE MEANING OF THINGS, Csikszentmihalyi and Rochberg-Halton (1981) observed that "When one traces the course of the self in ethnographic and historical reports, it appears that most traditional peoples have emphasized the integrated or social self at the expense of personal uniqueness [...], whereas modern Western culture has tended to stress the differentiated, uniquely individual self [...]." The authors also refer to Simmel's observation that the breakdown of traditional norms affords loss of affective life and increase of individuality. The trend is one of division.

The symbiosis of a person with a building is subject to the division that occurs in the social. With individualism and the cultivation of self, the focus shifts from the family being the home to the house materializing the home.

Building and Symbiosis

In the transition from vernacular to modern, a major division that occurs is the division of use. This division of use of course relates to a division of affordances.

In vernacular, building comes from what the household demands, i.e. from a need for extra value of use. The more a building affords, the higher its value of use. This value of use depends on the skills of the user, and therefore on how vernacular the object is. Since in a market situation the end-user and his skills are unknown, an object affords less. The market compensates this by diversifying affordances, i.e. by offering the choice to customers. Instead of a building that affords all kinds of use (as in vernacular), the market offers a range of rooms and building elements that each afford little, but together make a house that affords various uses and thus has exchange value. This division by the way is a source of accumulation as discussed above. In the chapter about Kitchen (page 231), the clay stove with a few pots evolved into a diversified kitchen with hundreds of items. The student's slum dwelling however has to keep to the vernacular approach since the urban scarcity of space does not allow much division of affordances.

Functionalism therefore is a division of affordances. The call for flexibility as a reaction to functionalism is indeed a counter movement as it opposes this trend of division, specialization, and eventually materialism. The trend is that in vernacular, an object can afford much to a user because the user is one with the object, whereas modernity segregates a building into a diversity of generic affordances, ignoring the specific user.

In the physical appearance of building, division occurs in the fragmentation of materials and certainly in tectonics. Whereas in vernacular building sophisticated

techniques are used to build wooden structures without the use of nails or screws, the extensive use of fittings and fasteners marks modern construction. Instead of stacking stone blocks in order to make a column, today natural stone panels are clad to a concrete pillar. Intricate fasteners afford invisible mounting in order to arrive at the same image of stacked blocks, but after a material detour typical of division.

Another level of division is that of material and maker. As known from Marxist theory, a side effect of the division of labor is the alienation of the factory worker from what he produces. The industrial product is something alien to the maker. In a similar way, one can no longer recognize the hand of the maker in the product. Division is a display of alienation.

The ultimate division is where the symbiosis itself is at stake. As seen under *Kacca* and *Pucca*, (in particular page 119), houses produced in mass production are hard to adapt and to make a home of. Dovey (1985) goes as far as to argue that the house as a house, not a home makes mass housing (not homes) equivalent to homelessness. Hardening thus results in the ultimate division, i.e. the end of symbiosis.

Society and Symbiosis

As is visible from the brief study on housing occupancy, censuses initially categorized people by their social context, then by formal categories, and later by technium and commodification. This trend is a combination of the division of the extended family into nuclear families, and the increasing use of material criteria to characterize people. The material gradually replaces the social.

The fieldwork in India showed that the convivial paradigm of co-existence in which people share everything from water, food, and home, to money and information, indeed shifted to the paradigm of competition. This shift is sharply visible in many of the slum improvement schemes, which require from slum-dwellers they untie from social structures and exchange the convivial for the competitive. Social cohesion in slums is often strong. For many, division is not an attractive perspective.

The shift from convivial to competitive has a parallel in the division into public and private. The strict segregation into public and private facilitates order in urban society. In an environment where the personal and the public are more fluid and meet each other in common space, order is more dependent of social structures. The loss of common space confines personal use to the private. The toilet for example, becomes a part of the house. This loss is a basic ingredient of sanitary and privacy issues in urban slum. In rural environments, people perform private activities in the privacy of the jungle. In the densely populated city, this privacy is not available in the outdoor; neither is it found inside the slum dwelling.

Division also marks the evolution of wedding ceremonies. The chapter about Wedding showed that in the vernacular environment, the wedding is about connecting families,

whereas the modern version has its focus on the wedding couple and the future (nuclear) family. The trend is individualization and the division of family. Similarly, the role of the home is different in the traditional Indian wedding where home remains a place attached to the family. The modern wedding produces another household, divided from the family home.

Formality and Symbiosis

Extensive division of labor marks today's building practice. Not only is the production of building elements divided in longitudinal sense, the industrial chain, there is also a spread in lateral sense, into all kind of domains. These disciplines include development, financial investment, architectural design, mechanical, electrical, environmental and structural engineering, maintenance, and operation. Moreover, governmental bodies, security, and professional care taking are also divisions of the building process. The cases of high-tech building showed that this division into domains affords analysis along not only the design hierarchy, but also performance criteria. All three cases showed the difficulty of matching all domains in order to come to a well performing building. Two main patterns occur. In one pattern, the building's design and construction are not equally satisfactory in all the domains, in the second pattern the domains collaborate too little or actually hinder each other.

Again, this is not only about the phase of design and construction, the patterns occur during the operational phase too.

In the RLC for example, the accessibility is according formal standards, but not according human needs and common sense. The building performs well in its function of landmark, whereas adaptability and sustainability are low. In Géopolis, the architect designed an open building intended for appropriation by the occupants, whereas the caretakers hinder personalization and close off whatever they can. The occupants' involvement in keeping the building alive is also hindered by the fact that caretaking is professionalized, which is typical of division. The caretakers' task is to keep things clean and tidy, not to manage a lively building. Liability (another formal domain) is an important driver for managers to prohibit personalization and hinder appropriation. The disrupting effects of division in the formal dimension are similar to the negative consequences of bureaucracy.

Commodification

Commodification as a basic ingredient of capitalism affords to people to buy a house without yet having the financial means for it. This way, people can live ahead of their financial wealth, in a place that is not a product of their household but purchased on the market. Commodification is by definition a major trend in the transition from vernacular to modern. It is where living in a place has become the subject of a

commercial deal and replaces vernacular symbiosis. Commodification brought fundamental changes to the relationship of people with their buildings.

People and Symbiosis

Although affording anticipated material wealth to people and thus improving the physical quality of shelter, commodification allows people less interaction with their building. Since occupants are bound to the exchange value of the building, the value of use is of secondary importance. Interaction serves for maintenance and value adding, with an anonymous future owner as target. A commercially successful object cannot bear too much of personal character as changing the building in order to improve its use-value is in principle at odds with keeping its exchange value.

In addition to the building becoming a commodity, occupants are commodified too. Whereas an owner who has no debts is truly independent, one who is subject to a mortgage is dependent on the market. A mortgage is a commodity and thus is the mortgager. Tenants are even more subordinate commodities. A proprietor can sell a house, including its rental agreement with the tenant. As described in the case study on Slum Improvement, in certain projects occupants are reduced to products, i.e. ultimate commodities (page 266).

Dovey (1985) observed that commodification "has its main eroding effect not in the quality of house form but in the quality of the relationship of the dweller with the dwelling". She points out that in a rental situation the owner's interests always limit the tenant's home making. If the owner is identifiable with the house and frequently present, the tenant will feel the owner's preferences. In addition, if the owner considers the house strictly a commodity, all personalization that might influence its exchange value is unwelcome. It eventually comes to exclusion of the end-user/dweller in order to preserve exchange value. By commodification, the dweller becomes a consumer of living space; the tenant is part of the commodity. Decorative painting and connection with the built environment, as seen in the cases of home inauguration, de-alienation, wedding, and personalization are typically vernacular. Commodification requires disconnection, i.e. no traces of use or personalization.

Hotels illustrate the dilemmas in symbiosis that come with commodification of living space. In the case of the owner being the manager, the hotel is an extension of the owner's desire to please and take care of the guests. The *owner* feels one with the hotel. The symbiosis of the *guest* and the hotel is different. Since the stay is of limited duration and none of the physical items is part of the guest's personal history, it is near to impossible to feel at home i.e. to speak of a symbiosis. The hotel guest lacks physical, autobiographical, and social insidedness. Moreover, the impersonal character of large-scale commercial hotels is inevitable since commodification requires the absence of traces of use, of other people. Hotels that feel more 'personal', more 'alive', show certain history and traces of use and thus afford 'autobiographical insidedness by

proxy'. Similarly, highly social competent, friendly, and caring staff will create an inclusive social atmosphere, mimicking social insidedness. Staffs are commodified household members.

In the personal dimension, the trend of commodification adds commercial interest to the meaning a building has for a person. The eroding effect of commodification comes from the detachment one has to practice regarding tradable objects.

Building and Symbiosis

In the modern world, a building is a commodity built of commodities. Commodification and division together afford the trend of accumulation mentioned earlier. The accumulation of built space per person is a physical extension based on economic power. This mechanism works well for those who know how to participate in the capitalist economy. It is in the transitional cases however, that commodified construction turns out not to fit every situation. The case of Pavement Dwelling (page 126) showed that the transition into mass housing is problematic due to both inadequate design and a too much supply driven approach. The dwellers lack the financial position to enter successfully the commodified housing system. Inevitably based on commodification, financial institutions lack ideas and products that would work for the convivial economy.

Projects like Mahila Milan show that vernacular 'design and build' is possible in the formal city. MM and the NSDF work with a convivial financial system affording demand-oriented development. Their projects prove that mass housing and commodification are not always the most adequate solution to the housing crisis. Instead, the projects are examples of genuine end-user participation. The result is housing that people want and that people can afford, without the risks that come with entering the capitalist financial system.

Depreciation of financial investments is typical of the use-value based economy. People pay for construction activities from their savings, i.e. from what they actually posses. Since there are no debts to be paid back, there is no acute need for returns on investment. In the exchange-value economy however, the aim is to not depreciate and instead make money in order to pay off debts.

Since diversification and functionalism help create more products, their opposites, i.e. multipurpose building and flexibility, are indeed counter movements to commodification. As seen in the case of Furniture, the introduction of single purpose items can set off a cascade of division and specialization that is only affordable for those who participate in the commodified economy. Thus, commodification molds the nuclear family.

Society and Symbiosis

Commodification of building and the use of property systems are tools society can use for keeping hold on people. Many a society for example, levies property tax for which the market value of real estate is the benchmark. The advance of commodification and materialism therefore are in the interest of those who are in power. The trend is that commodified symbiosis takes over convivial symbiosis.

Homelessness and nomadism can exist well in vernacular environments, whereas it is problematic for the formalized world. The top end variety of homelessness though, is manageable for society simply because it is commodified. The homeless executive for example, who spends more nights in hotels than at home, is not considered a vagrant roaming the city because he participates in the market of commodified shelter. The structures that support commodification afford social control at the same time.

Social capital is a notion opposite to commodification. Since it refers to connections among people i.e. the norms of reciprocity and trustworthiness in social networks, social capital is not quantifiable in monetary terms. It is therefore inevitable that economic segregation interferes in social structures. In the built environment, communal space and communal property are important facilitators of social capital. Since 'communal' is a category formalization and property systems find hard to handle, the trend is one of segregation into either public or private property. Commodification is inevitably detrimental to social capital.

Since housing in the modern city is commodity, the social composition of a neighborhood does not come from interpersonal contacts, but from the forces of the market. The composition of the population results from building supply. Urban planning is equally different from interpersonal contact. Consequently, neighbors are not readily members of the community and find it hard to build social capital.

In urban informal settlement, the reverse is visible when people want better housing but are not willing to sacrifice their social capital. Rather than living in a modern multi-storied building, they prefer to stay with their family and friends in the slums. Commodified mass housing schemes demand too high a price in social capital. Since one cannot quantify the exchange rate of social to physical capital, dialogues between slum dwellers and developers are complicated. As mentioned, SPARC, MM, and NSDF base their projects on a convivial model able of using social capital. At the heart of their strategy lies the notion that building homes is more effective than building commodities.

Formality and Symbiosis

Commodification itself is part of the formal dimension because it is an abstract construct with no physical properties. Formalization and individualization are facilitators of commodification, since both enhance the notion of property. The combination of commodification and formalization pushes the symbiosis to its limits.

Instead of 'having a home' one now 'owns property' and instead of participating in the communal, one makes a financial donation. Both formality and commodification are trends that have disrupting effects on the symbiosis. Paradoxically, commodification affords having a big house to people, whereas at the same time it puts people on an existential distance.

In the study on Slum Improvement, despite the complexity of the whole scheme, slum dwellers sold their rights to a tenement in a redevelopment project, i.e. commodified their formal position. Others, in all abstraction, commodified themselves by accepting free of cost housing. The case studies in India show that the regular financial system cannot understand the needs of the poor in the sense that banks cannot deal with social capital and the informal economy. Hence, they have the tendency to eradicate the informal sector.

Formalization

People and Symbiosis

The man-building symbiosis is a key element in formal identification procedures. Since names are often not unique, additional information like home address and place of birth is used to specify a person's identity. Many a formal institution is only accessible for those who have a fixed address.

The increasing role of formality can lead to situations of suffocating bureaucracy, where people are limited in what they can do with their building. Although many frustrations come from unintended side effects of legal restrictions, the overall consequences are imposed docility and suppressed creativity. Similar to commodification, formalization affords less interaction and thus disconnects people from their buildings.

Building and Symbiosis

Formalization is visible in building design that results from building codes. Most of the regulations in building codes originate from the desire to stem unsafe and unhealthy building practices. Consequently, most regulations consist of written down common sense. Frictions however occur when the design is exceptional and does not fit with the standard legal framework. In the RLC case, the building meets the legal standards regarding wheelchair accessibility, but is in practice barely usable for anything that rolls. The case study showed that formalization not only puts restrictions but also inadvertently provides loopholes, through which designers can justify their avant-garde proposals. Although common sense says that a well accessible library requires a level floor, strict interpretation of the law (that had not foreseen an undulating building) affords the exclusion of wheelchair users from large parts of the building.

As seen in the analysis of slum improvement projects, formalization takes physical shape in spaces that exclusively serve circulation (page 280). In modern building, certain spaces and construction elements are the *explicit* answer to regulations. Fire escapes on front facades are iconic of New York City. This explicitness is a form of formalization in itself. Such buildings almost require no formal certification. This is also the mechanism by which functionalism facilitates formalization. By assigning explicit functions, the building becomes measurable, assessable, testable, verifiable, and eventually permissible.

Besides formalization understood as the society and culture of regulations, it also covers the technium as an increasingly independent phenomenon. The case studies on high-tech buildings suggest that building services become so autonomous people cannot be allowed personal control over them. The obligation to meet certain standards, for example the *Minergie* standard for energy efficiency, is often argued as justification for this autonomous position. This means that in the symbiosis, the technium becomes a third party interfering in the others' relationship. In analogy with a 'legal person', the technium now forms a 'technical person'.

Society and Symbiosis

Formalization is the mechanism by which people relate to an ever-bigger part of society. In vernacular environments, communities have their local standards and codes. Formalization carries these standards beyond the local context, into society. Thus, formalization enlarges people's action radius but also makes people subject to a bigger society. Many of the EU's growing pains pivot around this effect.

India's caste system is formalization. Guilds stood at its origin and people could migrate from one caste to another. The British colonizers remodeled it after their own class system and thus made it more rigid. Whereas castes aimed at inclusion, the colonizer used it for exclusion, i.e. to 'divide and rule'. The informal sector is obviously a refuge for those who suffer most from this exclusion. Many South-Indian Tamils for example moved to Dharavi in order to escape from the restrictive caste system. The fear of exclusion feeds reluctance to participate in the planned city's formalization.

Formalization can on the one hand improve a person's situation as it affords access to capitalist systems, whereas on the other hand it can make people subject of excluding policies. Overall, it increases the influence of external factors on symbiosis.

Regarding the evolution of formalization, as seen in the study on home occupancy, census categorizations show that in 1830 people were seen as part of social contexts, later as samples of administrative categories, and in modern times as related to homes in physical terms. This means that formalization matured to an autonomous phenomenon once it could build on its own product: administrative categories. It eventually hinges on the symbiotic relationship of a dweller and his dwelling. This is

why societies have trouble with nomadism, why *Het Wilde Wonen* is nearly impossible in The Netherlands, and why societies engage in the criminalization of homelessness.

Rehousing the poor has a double-faced relation with formalization. The two sides serve each other. The latter is a crucial factor in making development schemes financially feasible, whereas at the same time rehousing projects lift slum dwellers out of the informal sector, i.e. formalizes them.

The case study on high-tech buildings showed that organizational issues could hinder people's control over their environment. The social hierarchy in the organization inhibited adjustment of building elements by office workers.

Formality and Symbiosis

As already mentioned, formality has become an autonomous phenomenon. As part of it, formal entities like municipal authorities, fire brigades, security companies, caretakers, and proprietors operate autonomously too. Since they are formal entities, not natural persons, their interests stand far from the end-user and the symbiosis. The case studies on high-tech buildings showed that conflicts of interest between formal entities cause situations like forbidden access to escape doors, fire compartments not respecting social territories, and energy saving policies not respecting personal comfort. The domains of these legal entities seem parallel universes. The natural person of the end-user has little influence in this since he is not a legal entity or participant in the formal structure. In addition, end-users in office buildings are rarely proprietors. Following the logic that 'money talks', the formal proprietor decides about the natural person's symbiosis.

Liability is a key factor in stalemates that occur between formal entities. Personal discomfort in *Minergie* certified buildings will remain as otherwise the party that solves the problem would be held liable for excessive energy consumption. The use of fire escapes in regular everyday practice would definitely contribute to the safety of the building. The security firm however, prohibits such daily use in order to avoid liability in case of burglary. The conflict of interest between safety and security is often resolved with technical provisions, i.e. by the third formal party of technium.

Human behavior is not a formal entity and therefore cannot compete with the formal parties mentioned above. In discussions with end-users, representatives of the formal parties usually justify the situation as 'a consequence of the design' or, more loosely phrased, 'the architect's idea'. Since the architect is usually not present in the operational phase of a building's existence, he is the easiest scapegoat. Again since 'money talks', the only chance for the end-user is to convince the proprietor of changing the situation. Between the two however stands the full distance of formalization and insurmountable liability.

Summary Matrix of Dimensions and Trends

Trend	Dimension			
	Personal	*Material*	*Social*	*Formal*
Accumulation	Decreasing housing occupancy. Increase of ego. Terminal materialism.	More built space per person. Functionalism. Specialization of use.	Home as a handle. Intention of housing everybody.	Increase of context.
Hardening	Less wear, less care. Adaptive Comfort Hypothesis. Learned helplessness. Loss of insidedness. Less sense of passage of time.	Steel, glass, cement. Exclusion of change. Exclusion from operation. Outsourcing. Non-operable windows	Organizational hierarchy. Authority to change. Prohibition of personalization. Criminalization of homelessness. Eradication of slums.	Formal systems replacing mutual agreements. Exclusion of the end-user. Extra-legal are considered illegal.
Division	Individualism. Extension of Self. From integrated social self to personal uniqueness.	Division of use. Specialization. Division of affordances. Obscuring tectonics. Alienation. Housed homelessness.	Division of the extended family into nuclear family. Competition replacing the convivial. Segregation into private and public. Weddings splitting households.	Division of labor. Specialization. Professional domains. Liability driven behavior. Bureaucracy.
Commodification	Mortgagers as commodity. Tenants as commodity. Slum dwellers as commodity. Dweller as consumer. Hotels mimicking home. Detachment from tradable goods.	Mass production of housing. Exclusion of the convivial. Functionalism and diversification. Supply replacing demand. Molding the nuclear family.	Disappearance of common space. The homeless executive. Commodified symbiosis. Loss of social capital. Population composition dependent on building supply.	'Having a home' becoming 'owning property'. Selling one's legal position. Eradication of the informal sector.
Formalization	Home address as part of identity. Imposed docility. Learned helplessness.	Legal framework replacing common sense. Functionalism facilitating formalization. Technium taking control.	Society replacing community. Formal organization replacing negotiation. Increase of external factors on symbiosis.	Bureaucracy. Technium becoming legal requirement. Legal entities in parallel universes. Exclusion of the natural person. Liability.

Table 7. Summarizing Matrix of Dimensions and Trends.

The findings of this thesis can be summarized in a conceptual framework containing a set of dimensions and a set of trends. These sets then can be combined in a matrix as in Table 7. Elements derived from both the literature review and the case studies all belong to a specific cell in the matrix. Together with the symbiosis model consisting of four dimensions as constructed in Table 4 (page 83), this matrix summarizes the conceptual framework.

Conclusions and Implications

Conclusions

The quality of how people relate to buildings has all to do with the degree of life of the built structure itself. Much of today's building however, goes a different direction; one that is no longer based on the live quality. This thesis investigates the forces and flows that cause the shifting away from live building, the trend identified as the *Untouchable Building Syndrome.* In order to unravel this syndrome, this thesis builds on Christopher Alexander's notion of live building by extending it to a combined life form, the *Symbiosis of People and Building*.

Alexander's work on how to make live buildings is a response to developments of modern architecture and urban design, in a dialectic that continues today. The aim of this thesis is to build a conceptual framework for this dialectic, i.e. the co-existence of live and non-live architecture.

By putting the symbiosis of people and building as the focal point and by investigating its context in order to create a conceptual framework, it is possible to identify what symbiosis is, how it works, which trends it is subject to, and finally how it can be used to assess the quality of people's relation to buildings.

The importance of this subject lies in the effects of the Untouchable Building Syndrome, i.e. the changing connection of people with their buildings. Diminishing or even loss of this connection results in poor living conditions, stress inducing buildings, and humanly not sustainable architecture.

The conclusions therefore consist of three parts. The first is about symbiosis as phenomenon, the focal point. The second is about the trends that mark changes in its context and thus in the changes that are visible in the symbiosis itself. The third part builds on the other two and consists of implications and recommendations.

Focal Point and Framework

In the symbiosis as a relationship, the two partners 'people' and 'building' are obviously key factors. There are however, external factors that closely relate to the symbiosis. These factors are grouped as follows. The fact that people connect with their buildings creates a handle for others and thus makes symbiosis subject of the social. Society therefore plays a role too and is the third factor. People and society are both factors consisting of human beings and their behavior. Buildings on the contrary, are artifacts. The fourth factor consists of abstract systems, i.e. the world of non-physical

intellectual artifacts. These four key factors i.e. people, building, society, and abstract systems, are the *dimensions* of symbiosis.

The *personal* dimension covers all elements in the human being that afford the relationship with building. It includes concepts like senses and perception in psychology and anthropology, along with meaning, comfort, learning processes, embodiment, bonding, operation, personalization, familiarization, coping strategies, and reflection of the self. It is essential for the proper functioning of the personal dimension that it involves action. The psychological components require physical interaction.

Buildings, the *material* dimension, have properties too that afford the symbiosis.

Affordances, adaptability, and flexibility are facilitators. Elements like wear and tear contribute to the sense of lived space and consequently live building. In addition, the building, to varying degree, is a reflection of the builder, and ultimately a reflection of the occupants.

The *social* dimension is about the role that symbiosis plays in social relations and activities, and how social life reflects in the building. It is the playing field of autonomy versus heteronomy, including phenomena like deportation and criminalization of homelessness. Various forms and degrees of physical and psychological violence can accompany such actions. Society uses symbiosis to locate and identify people and thus create social structures. Symbiosis also affords the use of a building as a person's proxy, i.e. other people (and society) can target a building in order to perform an action upon a certain person.

The *formal* dimension is the domain of the virtual. It holds abstract systems, legal persons, the technium, property systems, legislation, commodification, the planned city, the market, and intellectual abstraction. It shapes buildings by means of rules, not by physical criteria. It channels human behavior through laws and policies, not by mutual feedback in face-to-face situations. It designates the inverse of natural persons, the building practice of the artisan, social behavior in communities, communal ownership, or convivial exchange of goods.

A summary of the four dimensions of symbiosis is the model shown in Table 8. The top half of the table covers people, whereas the lower half is about artifacts. The left half covers the physical world of people and building, the right half is the domain of the virtual, interaction, events, and the kinetic.

This model affords assessment of the people-building symbiosis in various ways. Coding a case with the elements of the respective dimensions, makes it possible to determine whether sufficient equilibrium for symbiosis is present. In the same way, it is possible to identify conditions that are detrimental to the symbiosis, and thus address issues in malfunctioning buildings.

	Personal	Social	
Behavior	**People and Symbiosis** Perception Operation Embodiment Personalization Place attachment Adaptation, adoption Existential, passage of time Extension of the body Connection with Self	**Society and Symbiosis** Identification Homelessness Nomadism Imprisonment House arrest Eviction Domicide Squatting Autonomy-heteronomy	*Interaction with other people*
Building as artifact	**Building and Symbiosis** Construction of building Production Incremental Accretion Generation Creation Operability Affordance	**Formality and Symbiosis** Technium Abstraction Commodification (Extra-) legality Property rights Accountability Formalization Ownership	*Intellectual artifacts*
	Material	Formal	

Table 8. Conceptual model of the symbiosis, consisting of four dimensions (repeated from page 83).

The phenomenon of star-architecture for example belongs chiefly to the formal, whereas informal settlement typically finds itself outside that dimension. High-tech autonomous building leans more on building than on people and thus has a strong material dimension, supported by the technium from the formal. 'Technological maximization' is the increase of the role of the Technium, at the cost of the personal.

Trends

The dimensions mentioned above are the building blocks of the symbiosis. In addition to creating this model, this thesis investigates what happens to symbiosis in the transition from vernacular to modern and high-tech. This transition can take place in time, like in historical development, or in place, as in comparing traditional rural living to high-tech modern building. The research revealed five main trends that characterize the transition. These trends are at the same time tendencies, since they have certain inevitability.

Accumulation is the increase of built mass per person. In parallel with the increase of wealth, people can afford bigger houses. The decrease of housing-occupancy also to leads to 'more house per person'. A house-owner is more tightly connected to a building than a tenant is. Through ownership, one accumulates economic and formal

context. Individualization has a similar accumulating effect as decreasing housing occupancy.

Hardening includes the application of tougher materials in building, as well as the use of more complex techniques that hardly afford changes by the end-user. It is also about buildings becoming more autonomous, again excluding the end-user. Hardening also occurs when organizational policies prohibit personalization and impose a social hardening. Building codes and zoning plans limit changes in the built environment and thus have a hardening effect. Criminalization of homelessness is the imposition of 'symbiosis with a hard home' on people. In the formal dimension, hardening is seen in the transition from mutual agreements to formal systems. The tendency to label people who have little access to legal systems as illegal and not as extra-legal, is symptomatic of formal hardening.

Division is about individualism, competition, loss of the communal. In addition, functionalism and specialization lead to separation. Bureaucracy is about separated, disconnected, divided institutions. In taking care of a building, division leads to liability driven behavior. The ultimate division is the disconnection of people and building, i.e. the end of symbiosis.

Commodification is the trend that things are increasingly turned into commodities. This applies to both objects and services. Whereas vernacular environments are communal and convivial, in modern and high-tech situations nearly everything is exchanged as a commodity.

Formalization is the increase of the role of intellectual artifacts. Whereas vernacular environments have their own agreements and in-house techniques, the modern world is marked by abstract legal systems and advanced technologies that exist independent of natural persons.

These five trends are strongly interrelated and facilitate each other. It is through these interrelated trends that the symbiosis of people and building is changing as follows.

The formal dimension is growing at the cost of the personal. The invention of legal entities having the capability of owning buildings has created a situation in which virtual, non-natural persons own part of the building stock. Intellectual artifacts own built artifacts. Consequently, when it comes to building a relationship with a building, natural persons are in competition with legal persons. The trend of accumulation is partly the creation of this 'artifacts owning artifacts' world.

As observed in the case studies on Slum Improvement and High-Tech Building, the legal person is replacing the natural person as the beneficiary of the project. The same goes for the Technium versus natural persons. Overall, 'formal persons' (i.e. legal, technium, et cetera) exist next to natural people.

Things would be surveyable if only the formal person would reside in the modern world and the natural person in vernacular. Problems occur however, when a formal person comes between natural persons, vice versa. The modern city however turns poor migrants from the countryside swiftly into commodities. In order not to disturb the formal context, engineers exclude the end user from operating the modern building. In addition, the 'money talks' principle dictates that if money comes from a formal person, then a natural person is in a subordinate position.

Moreover, the trend of division also occurs between the distinguished domains of the formal dimensions. Consequently, it is important to continuously search for balance between aspects. When we see symbiosis as the combined life form, its health is determined by its ability to fulfill its own needs, the goals of the community and the laws of nature, to reconcile these patterns, and to establish a balanced order. Division however hinders this tuning process. Thus, the transition to modern is marked by disconnection and thinning. The symbiosis of people and building faces disconnection in a context of artifacts owning artifacts. Thinning comes from the accumulation of goods per person.

Overall, there is a shift towards artifacts and with that, a shift from autonomy to heteronomy. This may seem at odds with individualization but after all, the formal sector lacks the cohesion of the social.

With the above, it is possible to assess relationships of people with their buildings and to identify the forces that lead away from Christopher Alexander's live buildings. The symbiosis is primarily made of natural persons and their live buildings. Intellectual artifacts like legal persons and technium however, get in the way and drive them apart.

Implications

Professional Practice

Live Buildings

The notion of live buildings as presented by Christopher Alexander is one of the pillars of the symbiosis concept. This thesis holds that several factors play a role in the feasibility of live buildings. The *dimensions* define the environment of live buildings, whereas the *trends* force the quality of buildings in the modern direction, i.e. away from live. In analogy with sailing, the dimensions describe the boat, whereas the description of the trends is the nautical map charting tides and currents. In order to sail successfully (=create live buildings), one must know the boat (=symbiosis model) and the nautical conditions (=trends).

Similarly, Carel Weeber's *Wild Dwelling* becomes more feasible by thorough investigation of the forces at play. The theory presented in this thesis is a conceptual

framework that can help navigate and negotiate the professional context that is often not favorable to vernacular, live building, and wild dwelling.

Autonomous Buildings

With the advance of information technology, buildings tend to become more and more autonomous, i.e. they exclude the end-user from operation. As we have seen, such exclusion is detrimental to the symbiosis, is asking for resistance, and eventually causes vandalism.

Slum Redevelopment

Their adhering to the formal dimension and exclusion of the end-user marks the least successful slum redevelopment schemes. Strategies that are more inclusive and have their base in the personal and the social, enjoy more support during construction and in the operational phase. Redevelopment projects can benefit from vernacular strategies, especially in situations where not all participants are used to the commodified way. The latter dictates that 'money talks', i.e. those who pay decide. A crucial point here is to determine who the real payer is. Only the top finance provider in a project really pays, since he is taking the highest risk. Lower players pay for something supplied to them and thus are mere consumers. Vernacular projects are by definition of participatory character.

With the symbiosis model made of four dimensions, in combination with the trends to which it is exposed, it is possible to design new strategies that fit better with the phenomenon of the informal sector meeting the formal city.

Sustainability and Symbiosis

Since the transition from vernacular to modern is also the trajectory of the loss of ecological sustainability in our way of building, the trends identified in this thesis are likely to hold clues for restoring that sustainability.

Accumulation for example, is a crucial part of people's 'ecological footprint'. Energy consumption and greenhouse gas emissions are the most known indicators of this footprint whereas from the symbiosis perspective, accumulation is more tangible in the amount of floor area, building material, and infrastructure per person. The lopsided proportion of man to built matter is the foundation of excessive ecological footprints. Moreover, one should multiply all these forms of accumulation with the growth of the human population in order to grasp the scale of the problem.

Hardening is directly responsible for increased energy consumption and waste production. Softer buildings allow easy adaptation; can follow occupants' needs; require less major overhauls; have better thermal properties; and leave recyclable waste.

Division is a direct cause of accumulation. Specialization and the division of labor make that one cannot easily make changes to his own building. Functionalism and the

division of living are the counterparts of flexibility and multi-purpose. Consequently, accumulation of materials and techniques is inevitable. Division is also the principle behind offering 'choice' in commodities to consumers. It is unlike the wholeness of 'response' to clients in vernacular.

Commodification thrives on individual ownership and materialism. Thinning housing occupancy and fragmentation of the family both result from and contribute to commodification. Similarly, commodification and materialism cause accumulation. Today's upcoming of the sharing economy is a countermovement and directly contributes to the symbiosis people have with their building. Sharing is the basis of communal ownership and common land, typical of vernacular environments. Today's popular practice of couch surfing for example proves that zero footprint vernacular solutions can work in today's commodified world.

As already mentioned, formalization is the trend that ultimately puts people on a distance from their building. Formal and technological maximization bring people to a state of learned helplessness and thus lay the base for disobedience. When a building's systems promote exclusion of people, its occupants will find ways to fool those systems and exclude them in return. Obviously, such situations are counterproductive to sustainability targets. Inclusive strategies, in which the end-user has an important and significant role, are more effective. In the four dimensions of the symbiosis model, the current focus on formal solutions is leading away from the personal and the social dimension. Strategies that aim at inclusion however, will strengthen the symbiosis and thus contribute to sustainability.

Scholarly Field

Unlike the often-heard argument, vernacular architecture is not something of the past, but something of all times. One of the causes of this misconception is that longitudinal studies of architecture history are inevitably one-directional (in time) and suggest that developments are bound to the course of history. Although the five trends that mark modernization and Westernization are typical indeed of recent history, it does not inevitably mean that vernacular architecture is becoming obsolete. Instead, vernacular and modern co-exist today as equally relevant for the profession. The transversal character of the case studies in this thesis illustrates this position and implies a potential reversibility of trends. The position that vernacular architecture is something of the past hinges on the assumption of a sequential relation with modernity, whereas a parallel order is more adequate.

Recommendations

Research and Education

The architecture practice would definitely benefit from a shift in research focus. The habitual action research for the realization of a certain solution, does not necessarily address the causes of a given problem. Justification of the design is mainly sought in what the new situation affords, and less in which needs are met. The delivery of a creation yields more attention than investigation of the demands. Thorough investigation and analysis however, are markers of convincing designs. Unfortunately, the absence of research tradition is emblematic of architecture education, unlike all other academic disciplines. Indeed, PhDs in architecture are rare.

When it comes to research on the symbiosis of people and building, an important obstacle is academia's segregation into universities and institutes of technology. Since architecture is taught in the latter, anthropology and psychology are rarely part of the curriculum. Unless architecture is strictly limited to building and not meant for people, humanities should be part of the education.

In architecture practice, research serves to identify *how much* to build and *what* to build. The first question is answered in a 'program of requirements', the second in the 'design'. Most of the research is quantitative. Research on aesthetic qualities is part of the artistic domain. In order to get closer to the actual symbiosis of people and building in a given project, it is recommended to add 'participatory research' to the architect's pallet, a methodology known from anthropology. Through such research, essential qualitative aspects contributing to symbiosis can be identified, implemented, and subsequently defended in the full length of the project.

Academic Concepts and Professional Practice

Regarding the definition of 'vernacular', this thesis suggests two refinements. First, where Illich (1983) speaks of "not made for the market" and Frey (2010) of "escaping the global flows of capital", the dialectic of supply and demand affords expression of the intention with which (vernacular) architecture is made. 'Demand', like 'need', gives expression to the connection with the people who make and inhabit such architecture, whereas 'supply' is detached and all about 'flows of capital'. Second, the interpretation of vernacular as 'own' (adjective), is different from the modern individualistic 'own'. The first is the relation to the context one is part of, whereas the latter is about the self.

In the formal sector, the notion of 'legal person' indicates an entity that can play a role in legal affairs although it is not a natural person. In this thesis, the concept of 'legal person' is in the category of intellectual artifacts, together with 'technium' and 'commodification'. The relationship between people and intellectual artifacts is in fact about natural persons and virtual persons. In analogy with legal persons, one could speak of technical person, ecological person, economic person et cetera. An advantage

of such vocabulary lies in the deliberate use of 'person', which implies the relation to natural persons. Moreover, these persons as embodiment of abstract phenomena fit like teammates or adversaries in the symbiosis model.

Symbiosis can only exist when people participate. Participation and direct involvement of the builder and the end-user nourish symbiosis. In order to enhance the symbiosis in a given project, it is recommended to investigate organization, procedures, practices, behavior et cetera regarding symptoms of the five trends. As argued above, the trends are indicative of loss of symbiosis. Next, an assessment of the project in terms of the four dimensions will afford the development of life enhancing measures.

Live buildings bear traces of daily use, of adjustment, of change. They also show the symbiosis of builder and building. In modern architecture, the artisanship of the builder is less visible. Today it is the task of the architect to deliberately introduce elements in the design that make the designer and builder visible, not through a perfect application of systems, but by creating buildings that bear witness of all.

Final Conclusions

The aim of this study was to investigate the relationship that people have with their buildings. Since the intention was to find ways to support a lively relationship between the two, 'symbiosis' was taken as the focal point. The model of the symbiosis, built on a combination of literature research and fieldwork, explains what symbiosis is and how it works. In addition, the conceptual framework gives answer to the question 'what is happening to our relationship with buildings?' This framework consists of the trends that explain the current loss of live architecture. The resulting model-cum-framework affords assessment of projects regarding their effects on symbiosis, i.e. on life of people in live buildings. For life to exist, people, buildings, and their symbiosis must be alive.

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Appendices

Appendix 1: Call for a Clean Wall

From: _____ @epfl.ch>
Subject: **Rappel important : Affichage**
Date: 12 mai 2014 12:09:12 HAEC
To: "batiment.bp@epfl.ch" <batiment.bp@epfl.ch>, "batiment.sg@epfl.ch" <batiment.sg@epfl.ch>, "batiment.aab@epfl.ch" <batiment.aab@epfl.ch>, "batiment.aac@epfl.ch" <batiment.aac@epfl.ch>, "batiment.tric@epfl.ch" <batiment.tric@epfl.ch>, "batiment.bm@epfl.ch" <batiment.bm@epfl.ch>, "batiment.co@epfl.ch" <batiment.co@epfl.ch>, "etudiants.ar@epfl.ch" <etudiants.ar@epfl.ch>
Cc:

▶ 1 Attachment, 5.9 KB

Bonjour,

Je me permets de vous rappeler que d'après le règlement de l'EPFL, il est strictement interdit de scotcher des affiches ou annonces sur les murs, les portes vitrées ou non (sauf celle de votre bureau), dans les ascenseurs ou autres...
Celles-ci sont systématiquement enlevées et jetées et ce travail peut être facturé aux responsables de ce placardage.

Merci par avance aux instituts, étudiants, associations et organisateurs de manifestations d'appliquer ce règlement pour éviter les problèmes.
Pour exemple, la peinture du bâtiment SG vient d'être refaite notamment à cause des traces de scotch laissées sur les murs et l'entreprise de nettoyages passe du temps à nettoyer les portes, les vitres, les ascenseurs...

Il y a plusieurs panneaux d'affichage à l'intérieur et à l'extérieur des bâtiments que vous pouvez utiliser. N'hésitez pas à me contacter si besoin.

Je vous souhaite un très bon début de semaine.

Avec mes meilleures salutations.

Appendix 2: Characteristics of Vernacular Environments

Process and Product characteristics in the definition of Vernacular Environments as by Amos Rapoport (1990a).

Process characteristics
1. Identity of designers.
2. Intention and purposes of designers.
3. Degree of anonymity of designers.
4. Reliance on a model with variations.
5. Presence of a single model or many models.
6. Extent of sharing of model.
7. Nature of schemata underlying the model.
8. Consistency of use of a single (same) model for different parts of the house-settlement system.
9. Type of relationships among models used in different types of environments.
10. Specifics of choice model of design.
11. Congruence of choice model and its choice criteria with shared ideals of users.
12. Degree of congruence and nature of the relation between environment and culture/lifestyle.
13. Use of implicit/unwritten vs. explicit/legalistic design criteria.
14. Degree of self-consciousness of the design process.
15. Degree of constancy /invariance vs. change/originality (and speed of change over time) of the basic model.
16. Form of temporal change.
17. Extent of sharing of knowledge about design and construction.

Table 9: Process characteristics of vernacular environments (Rapoport, 1990a).

Product characteristics
1. Degree of cultural and place-specificity.
2. Specific model, plan, forms, morphology, shapes, transitions, (e.g. inside/outside; interface, entrances) etc.
3. Nature of relationships among elements and the nature of underlying rules.
4. Presence of specific formal qualities: complexity, solid-void relationships, fenestration, massing and volumes, articulation level changes and how handled, the nature, complexity and articulation of urban spaces and degree of variations in their use of light and shade, use of vegetation etc.
5. Use of specific materials, textures, colors, etc.
6. Nature of relation to landscape, site, geomorphology, etc.
7. Effectiveness of response to climate.
8. Efficiency in use of resources.
9. Complexity at largest scale due to place specificity.
10. Complexity at other scales due to use of a single model with variations.
11. Clarity, legibility and comprehensibility of the environment due to the order expressed by the model used.
12. Open-endedness allowing additive, subtractive and other changes.
13. Presence of 'stable equilibrium' (vs. the 'unstable equilibrium' of high style).
14. Complexity due to variations over time (change *to* model not *of* model (as in process characteristics no. 15).
15. Open-endedness regarding activities: types, numbers, overlaps, multiple uses, etc.
16. Degree of multisensory qualities of environment (large range of non-visual qualities).
17. Degree of differentiation of settings – number, types, specialization, etc.
18. Effectiveness of environment as a setting for lifestyle and activity systems (including their latent aspects) and other aspects of culture.
19. Ability of settings to communicate effectively to users.
20. Relative importance of fixed-feature element vs. semi-fixed feature elements.

Table 10: Product characteristics of vernacular environments (Rapoport, 1990a).

Appendix 3: UN-Habitat Threshold Values for Slums

Characteristic	Indicator	Definition
Access to water	Inadequate drinking water supply *(adjusted MDG Indicator 30)*	A settlement has an inadequate drinking water supply if less than 50% of households have an improved water supply: • household connection; • access to public stand pipe; • rainwater collection;[i] with at least 20 litres/person/day available *within an acceptable collection distance.*
Access to sanitation	Inadequate sanitation *(MDG Indicator 31)*	A settlement has inadequate sanitation if less than 50% of households have improved sanitation: • public sewer; • septic tank; • pour-flush latrine; • ventilated improved pit latrine. The excreta disposal system is considered adequate if it is private or shared by a *maximum of two households.*
Structural quality of housing	a. Location	Proportion of households residing on or near a hazardous site. The following locations should be considered: • housing in geologically hazardous zones (landslide/earthquake and flood areas); • housing on or under garbage mountains; • housing around high-industrial pollution areas; • housing around other unprotected high-risk zones (e.g. railroads, airports, energy transmission lines).
	b. Permanency of structure	Proportion of households living in temporary and/or dilapidated structures. The following factors should be considered when placing a housing unit in these categories: • quality of construction (e.g. materials used for wall, floor and roof); • compliance with local building codes, standards and bylaws.
Overcrowding	Overcrowding	Proportion of households with more than two persons per room. The alternative is to set a minimum standard for floor area per person (e.g. 5 square metres).
Security of tenure	Security of tenure *(MDG Indicator 32)*	• Proportion of households with formal title deeds to both land and residence. • Proportion of households with formal title deeds to either one of land or residence. • Proportion of households with enforceable agreements or any document as a proof of a tenure arrangement.

Note: i 'Well' and 'spring' are considered acceptable sources in the original MDG indicator but are almost certain to be polluted in urban areas.

Table 11. Indicators and threshold values for categorizing slum. Source: (UN-Habitat, 2003).

Appendix 4: Curriculum Vitae Sytse de Maat

2010-2015 PhD candidate at EPFL, Switzerland

Besides participating in the EDAR doctoral program, I participated in the EPFL Teaching in Higher Education Program, and facilitated the Instructional Skills Workshop. In the faculty of ENAC, I was in charge of the *Unité d'Enseignement* (Teaching Unit) 'Architecture and the Human Hand' in both 2013 and 2014.

2009-2010 The Perfect Slum
Weblog project investigating informal urban development as an example of building on a strictly practical basis. The idea for *The Perfect Slum* first occurred on a field trip with Columbia University New York to Dharavi Mumbai.

2008 Special Purpose Company Duo²
Design manager for a PPP-project in a consortium of Strukton, Arup, UN Studio, and Worksphere. Responsibilities included the integration of architectural design, structural engineering, service engineering, maintenance, and operation. The project involved a new building for the finance department of the Dutch ministry of education.

2007 Architectural Photographer in Tokyo
For an architecture guide authored by Geeta Mehta and Kim Carew Reid, I made pictures of more than 400 projects in Tokyo. The job offered an opportunity to do research on the many aspects of life in the largest city in the world.

2006 Temple University Tokyo Japan
Studying with prof. dr. Geeta Mehta in preparation for a future PhD study.

2005-2009
Self-employed architect. The activities include own projects and freelance work.

1995-2005 Takenaka Netherlands BV
Takenaka is one of Japan's major design and construction companies, founded in 1610. Job titles: architect; project manager; chief design department; auditor quality assurance system ISO 9001-2000.
Although the Takenaka Netherlands office is in Amsterdam, I also worked for the offices in Brussels, Düsseldorf, Frankfurt en Paris. In Zilina (Slovak republic), I worked as senior architect on a new production plant for a Korean automotive client.

1995 Manten & Lugthart architects BNA, Netherlands
Assistant designer.

1990-1994 Johan van Lonkhuijsen interior designer BNI, Netherlands
Assistant designer.

1983-1990 Eindhoven University of Technology, The Netherlands, Architecture
Graduated at section Building and Environment under Prof. Mag. Arch. Peter Schmid.

1982-1983 Eindhoven University of Technology, The Netherlands, Physics

1976-1982 Stedelijk Gymnasium Breda

Born in Breda, The Netherlands, 16 November 1963